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A TEXT BOOK FOR MIDWIVES

JOHN S. FAIRBAIRN

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A TEXT-BOOK FOR MIDWIVES

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FOR

MIDWIVES

BY

JOHN S. FAIRBAIRN

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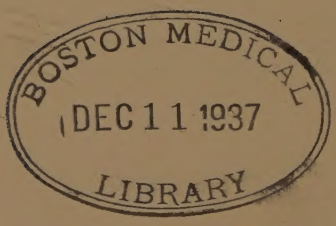

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PREFACE TO FIFTH EDITION.

This Edition has undergone a general revision and some rearrangement of its matter. The chapter on Antenatal Care and the section on Abortion have been transferred from the later part of the book to their proper setting in Part II.; the last two chapters in Part VIII. have been brought into Part III., and thus into direct relation to the management of Labour; and two items in the Appendix have been expanded and incorporated in the main text as Chapter XXIX. The Physiology of the Reproductive Organs and Reproduction has been brought up to date and some new figures added, for three of which my thanks are due to Professor Teucher, of Glasgow. Some additional matter in these chapters has been printed in the same small type as adopted for the instruction for those working abroad where medical help is not readily obtainable, in order to indicate that it is not meant for the pupil-midwife. It represents part of a lecture to midwives on "The Marvels of the Start of a New Life," which has been repeated more than once by request, and a place has been found for it here on the suggestion of some of those who heard the lecture and wished for the gist of it in permanent form. The final chapter on Maternal and Infantile Mortality has been included, as its matter is of concern to all in the midwifery service.

By excision here and there, wherever possible without interfering with clarity or the character of the book, it has been possible, in spite of new matter and six new illustrations, to avoid adding appreciably to the number of its pages.

Since the appearance of the previous edition, an examination for midwife teachers has been initiated by the Midwives' Institute, and in the near future will probably be taken over by the C.M.B. The requirements of those preparing for this examination have been kept in view, and those of teachers generally, for it is a great satisfaction to the author to hear that this book has proved useful to teachers as well as to pupils. Further suggestions in this direction, and with a view to maintaining its adequacy for the purpose it was originally designed to serve, will be welcomed.

JOHN S. FAIRBAIRN.

45 Queen Anne Street, W.,
April 1930.

PREFACE TO FIRST EDITION.

For adding another to the many text-books from which the midwife can make her choice I can plead two excuses. First, that this one has certain characteristics of its own; and second, that what special features it may possess represent an experience of the needs and aspirations of midwives acquired by over twelve years' association with them, as teacher, examiner, post-graduate lecturer, and medical colleague. This text-book contains more than has hitherto been considered necessary for midwives, and is open to the criticism of going beyond what is required by them and of them. On this score, however, those who know the more advanced school of practising midwives will make no demur. That school is possessed with an insatiable thirst for knowledge, and is rarely content with what has hitherto been given it in books written solely for midwives. Formal medical works are in constant use, and my hope is that the scope of this book has been made wide enough to render the purchase of such unnecessary.

The Introduction, on Physiology and Bacteriology, the space devoted to obstetric complications and the operative procedures in connection with them have been included partly with this idea.

There is, however, another and a better justification for a comprehensive book. A more educated class is now coming forward to qualify as midwives, and for some time past there have been discussions as to the advisability of raising the standard of training and examination. Only the fear of the increased expense and diminished supply, involved by the necessary lengthening of the period of study, has delayed the adoption of this reform, which, sooner or later, is bound to come. This book is my contribution towards meeting the legitimate aspirations of the midwife for a higher professional education.

The first difficulty which the teacher who aims at progress in this direction has to face is the want of knowledge of the elementary principles of physiology among many of his pupils. It is chiefly to meet this that the Introductory Sections have been included. Even if not studied thoroughly, they are available for reference. But without some effort to obtain a knowledge of the bed-rock principles on which all medical science is founded, little advance will be made by the midwife. For the teacher's second and greater difficulty is the lack of that mental drill and training in scientific method which the study of the preliminary sciences is designed to give the medical student before he begins his professional work. I have endeavoured to make the theoretical portions of this book as educative as possible, so that they might act in some slight degree as an equivalent to the pupil-midwife of the early studies of the medical curriculum. By frequent insistence on the pupil's working with the pelvis, the skull, prepared specimens and models, and by reference to points she may see for herself in the lying-in room and elsewhere, an effort has been made to train her in observation and deduction. The illustrations of actual specimens, several of them in regular use for the instruction of midwives at the General Lying-in Hospital, have been inserted with the same object. Throughout, my endeavour has been to make the pupil reason out things for herself and not merely to learn like a parrot. With this end in view, I have preferred to quote in the text

the rules of the C.M.B. wherever they apply and when necessary to explain their rationale, rather than to adopt the usual custom of reprinting them *en bloc* at the end of the book.

No attempt has been made to avoid repetition, and cross references have been frequently inserted; condensation and tabular arrangements have been eschewed. In teaching the elements of any subject the only way to impress points on the student is by constant repetition. Tables and lists are but a temptation to learn by rote. The descriptions to the figures have been made full and exhaustive and frequently repeat what can be found in the text. This has been done with a purpose. There is no better method of refreshing the memory before an examination than by a study of pictures and diagrams, and such revision is fortunately only useful to those who have already made an intelligent study of the subject.

On the practical side there is little scope for advanced teaching. The practice of the midwife is strictly circumscribed by the regulations of the C.M.B. A few hints are given in small print to help those—in the Colonial Nursing Service or Mission Field, for instance—who may have to work under very different conditions as regards accessibility of medical help from those who practise within the jurisdiction of the C.M.B. In the chapter on Obstetric Operations suggestions as to preparation for, and assistance at, the various procedures and for the after-care of the patient have been given. The important points in nursing complicated cases are included, not only because the midwife must frequently act as nurse but also because the fact cannot be lost sight of that many pupils in the training schools intend to practise solely as monthly nurses.

A Glossary of Medical Terms has been added, so that the beginner meeting with a word she does not understand can refer first to the Index to see if it is explained elsewhere in the book, and, if not, then to the Glossary.

An exhaustive Index has been prepared to facilitate reference.

I trust that my ideals, however far short of them my methods of expressing them may fall, may prove helpful to other teachers. I can at any rate assure them that nearly everything in this book has at one time or another been taught to classes made up of all sorts and kinds—from the fully trained nurse to the handy village woman sent up by her County Council for training—and that I have found, provided full use is made of specimens, models, and blackboard demonstrations, that the teaching outlined in this book can be followed intelligently by any woman of sufficient education to become a midwife. The difficulty of the less educated is rather to find adequate expression for what they have learned, and especially to put it in writing.

My thanks are due to the Publishers for the loan of anatomical blocks, and to Professors Muir and Ritchie for four illustrations of bacteria. I wish also to express my thanks to Miss Olive Haydon, Labour Ward Sister at the General Lying-in Hospital, and Dr. J. Abernethy Willett for suggestions and assistance in proof-reading.

J. S. F.

42 Wimpole Street, W.
September 1914.

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A TEXT-BOOK FOR MIDWIVES

INTRODUCTION.

GENERAL ANATOMY AND PHYSIOLOGY.

BEFORE commencing the study of midwifery the pupil ought to have an elementary acquaintance with the structure (anatomy) and functions (physiology) of the more important organs and tissues of the human body. So, before discussing those anatomical and physiological problems which specially concern the pupil midwife, a general sketch of the framework of the body and of the elementary principles by which the functions of the various organs and tissues are carried on will be given. In many cases the pupil will have had general nursing training, and will have learnt all and more than is contained in this Introduction. If so she can pass it by and begin with the purely obstetrical chapters; if, however, the pupil has not had the advantage of previous instruction in human anatomy and physiology, this introductory section must be carefully studied before attempting the more special obstetrical anatomy and physiology, as its matter is included among the subjects of examination in the regulations of the Central Midwives Board (C 5 (*o*)). The actual knowledge she will acquire is not the only advantage she will gain. The mental exercise in thinking out the meaning of scientific facts will be an excellent preparation for the practical study of her calling. A medical student devotes over two years to such preliminary study, so the midwife student need not grudge a few hours to preparing her mind for her professional instruction.

A. ANATOMY.

I. THE SKELETON.

In all schools an articulated skeleton should be kept for teaching purposes. If not, the pupil must study it at some museum or hospital, as this section must be read with the skeleton before her.

It will be seen that the skull is carried on a long column of jointed bones—the spinal column or backbone. The spinal column, being made up of many small bones (vertebræ) jointed together, allows very free movement backwards and forwards and slighter movement from side to side. Immediately below the skull come the vertebræ of the neck, seven in number, and as they have no ribs attached to them they allow a very wide range of movement of the head—backwards, forwards, and from side to side. Below them come the twelve dorsal vertebræ, which are more limited in mobility and are distinguished by having the ribs attached to them. Below them, again, are five more vertebræ without ribs—the lumbar vertebræ, which form the only bony connection between the upper and lower parts of the skeleton. Attached to the last of these is the sacrum, formed by five vertebræ welded together, and below it the little rudiment of a tail—the coccyx. These last two, forming part of the pelvis, will be described more fully when that structure is described from the obstetrical standpoint.

The hollow of the skull or cranium, containing the brain in the living subject, communicates by an opening in the base of the skull—the foramen magnum, with the hollow or canal which runs down the spinal column—the spinal canal, containing the spinal cord or marrow in the living subject. The brain and spine together form the central nervous system, to and from which run the nerves of the body.

Next turn to the cage-like portion of the skeleton enclosed by the ribs. This is the chest or thorax. It will be seen that the twelve ribs on each side arise from the dorsal vertebræ and pass forward to join the breast bone or sternum, which runs down the middle line of the front of the thorax. Note the way the lower ribs bend down from the spine and then up again towards the sternum, thus making a wide opening in front at the lower part of the sternum; this is called the substernal notch.

Attached to the upper part of the thorax are the bones of the shoulder and arm. The shoulder blade (scapula) moves on the back of the upper ribs and is attached to the skeleton only by means of the collar bone or clavicle, which runs from it to the top of the sternum. On the shoulder-blade is the shoulder-joint, receiving the head of the humerus, the bone of the upper arm.

Turn now to the lower part of the skeleton; the pelvic bones form the ring or girdle attached above to the last lumbar vertebra, and contain on each side the deep cup (acetabulum) of the hip-joint into which is articulated the femur or thigh bone. In the erect position the pelvic girdle transmits the weight of the body to the legs at the hip-joint.

Certain bony points occasionally referred to in midwifery ought to be identified : the acromion process on the shoulder-blade which forms the point of the shoulder ; the olecranon process of the ulna which forms the point of the elbow ; the patella or kneecap ; the external and internal malleolus which form the projections on each side of the ankle-joint, and the backward projection of the os calcis which forms the bony part of the heel.

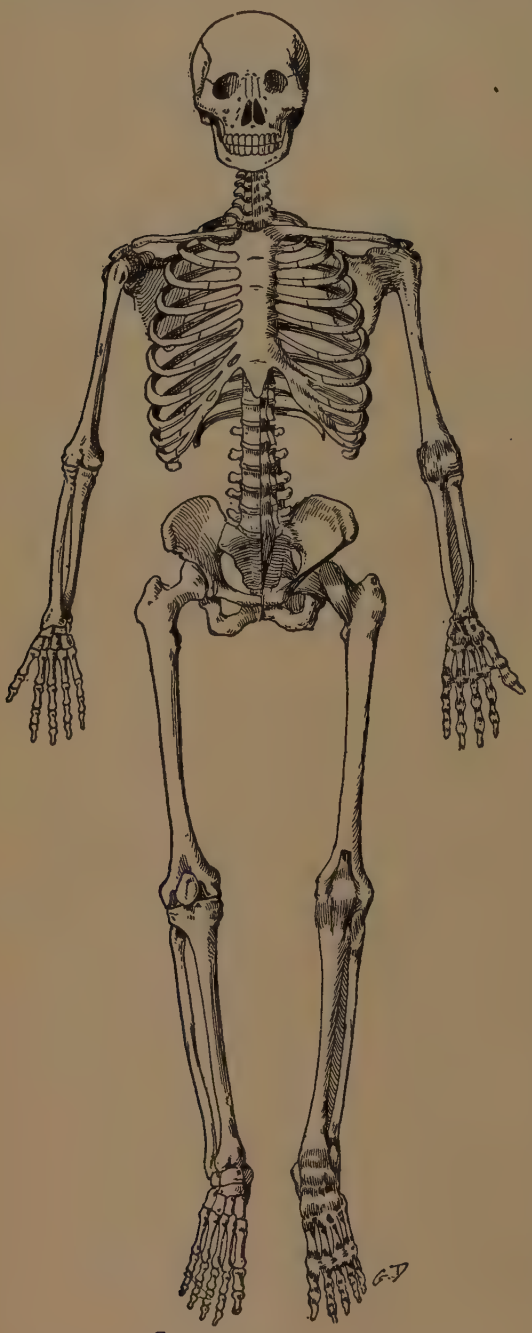


FIG. 1.—THE SKELETON.

The ligaments are sketched in on the left side.

II. THE ORGANS AND STRUCTURES OF THE BODY.

I. **The Nervous System.**—Having briefly noticed the salient features of the bony framework, the organs and structures supported by it must now be considered and fitted into their places in the skeleton. The brain and spinal cord have been mentioned as the central nervous system, and as forming the contents of the cranium and spinal canal. The actions of the body are governed by the brain through the spinal cord and the nerves. Some nerves communicate directly with the brain and are known as the cranial nerves. Among these are the nerves of smell, which pass from the nose through the base of the skull to the brain ; the nerves of sight or optic nerves, which, together with the nerves which direct the movements of the eyeball, pass through the back of the orbit or cavity which contains the eye ; similarly, the auditory nerve passes from the ear, and the nerves of taste from the tongue, to the brain, and also the nerves of sensation or feeling from the mouth, palate, teeth, jaws, face, and scalp, and the corresponding nerves which govern the movements of the muscles of these regions. There is one cranial nerve, however, which forms connections much farther afield, and that is the vagus or tenth cranial nerve, which goes to the throat, lungs, and heart and to the stomach and intestines. The nerves for the rest of the body do not come directly from the brain, but are connected with it through the spinal cord. These spinal nerves lead off from the cord in pairs, one for each side of the body, and emerge from the spinal canal between the vertebræ. For instance, those for the arm come out between the lower vertebræ of the neck, and those for the leg from between the lumbar vertebræ and sacrum and form a big network in the hollow of the sacrum.

The heart and blood vessels, and the organs and hollow viscera of the body are supplied by the sympathetic nervous system, the most important part of which is a pair of nerve cords with ganglia running along the vertebral column and connecting with the spinal nerves and vagus and other cranial nerves.

The brain, besides being the seat of the mental processes, governs the actions of the body and appreciates all the sensations brought to it from the nose, eye, ear, tongue, and palate, and from the skin and other parts of the body. This is done by means of the nerves, which, like electric wires, take messages to and from the brain. Those nerves which take messages from the brain and govern the movements of the limbs and muscles generally are called " motor " (efferent) nerves, and those which carry messages or sensations from the body to the brain are called " sensory " (afferent) nerves. Most of the nerves are bundles of both motor and sensory fibres, but some are purely motor and some purely sensory.

II. **The Lungs.**—Turning now to the thorax or chest, we will first describe the lungs. From just behind the tongue there passes down the neck into the thorax the windpipe, or trachea, which carries air to the lungs (Fig. 10). In the thorax it divides into two tubes—the bronchi, one bronchus going to each lung and breaking up into smaller and smaller tubes so as to bring the air to all parts of the lung. The larynx or Adam's apple, which can be felt in the neck, is a box-like swelling in the trachea containing the voice-producing apparatus—the vocal cords or glottis. The passage of air to and from the lungs can be stopped by closing the glottis as in "holding the breath."

The trachea and the bronchi are lined with a moist surface known as a mucous membrane, which produces a secretion of mucus and helps to withdraw from the air particles of dirt and dust. When these tubes are inflamed in bronchitis, bronchial catarrh, or "cold in the chest,"

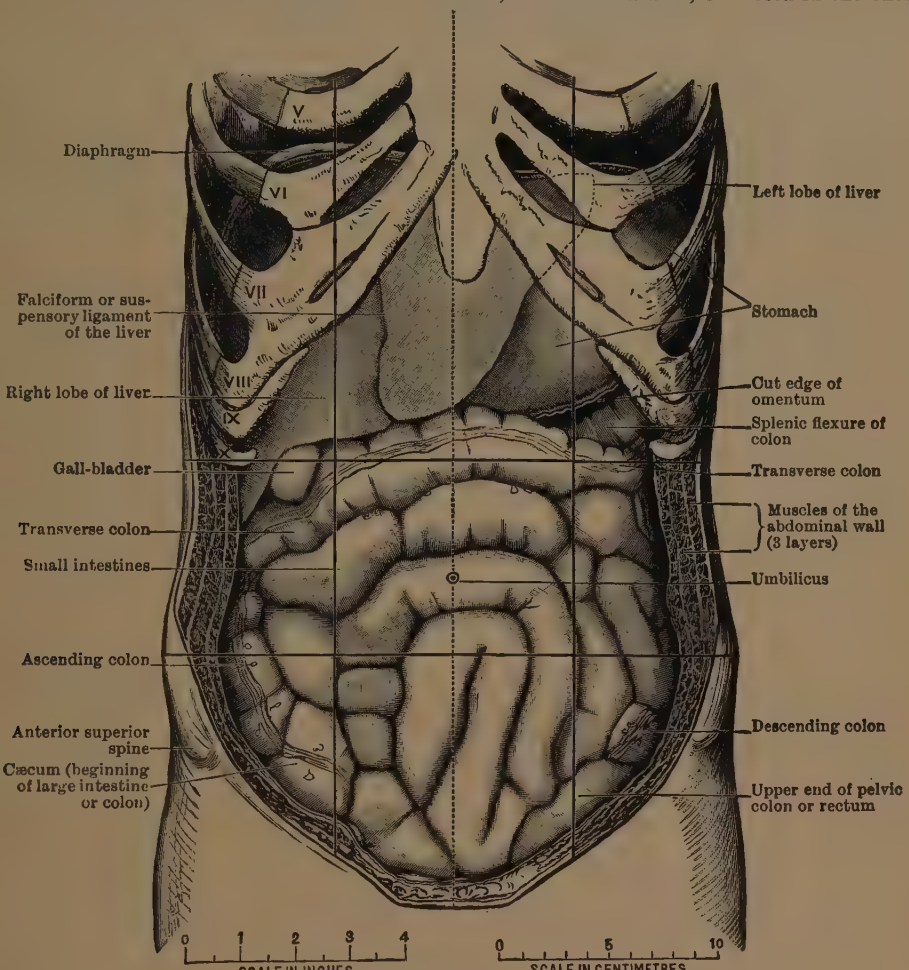


FIG. 2.—THE ABDOMEN AND ITS CONTENTS.

The large intestine is distinguished from the small intestine by having three flat muscular bands arranged lengthways along its course; one of these is shown. See also Fig. 10.

this secretion becomes excessive and gives rise to the coughing up of the increased secretion or "phlegm." The lungs are bags of spongy tissue containing air cells which may be compared with those of a honeycomb, and in them the blood is aerated during breathing. They expand when the chest is enlarged on taking a breath (inspiration) and contract when the breath is expelled (expiration), moving freely in the cavity of the chest (the pleural cavity). The outer surface of the lungs and the whole of this cavity is lined with a smooth membrane, the pleura, which allows the easy movement of the lungs.

III. **The Heart.**—The heart, with the large blood vessels going to it and coming from it, is placed between the lungs just behind the sternum, but rather more to the left side than the right, and is enclosed in a special sac of its own, the pericardium, also lined with a smooth membrane to permit of free movement.

IV. **The Œsophagus.**—The other important structure in the thorax is the gullet or œsophagus, the tube which passes from the mouth along the front of the vertebral column and just

behind the trachea to the thorax, which it traverses on its way to the abdomen to open into the stomach (Fig. 10).

V. **The Abdomen and its Contents.**—The abdomen forms the lower part of the trunk. It extends from the ribs above to the pelvis below, and in the living subject the large open space between these parts of the skeleton is closed in by thick masses of muscle forming the abdominal walls. The cavity thus enclosed is the abdominal cavity; its roof is formed above by a dome-shaped muscle known as the diaphragm, and it is completed below by the pelvic floor (see p. 46–8). It contains the digestive organs—stomach, intestines, liver, and spleen, and also, in the flanks, the kidneys with the urinary ducts, the ureters, which run from them to the bladder in the pelvis.

The abdominal wall is largely composed of muscle and is of great importance in supporting the contents of the abdomen. A hernia or rupture is caused by some of the abdominal contents being forced out through a gap in the muscular wall of the abdomen. The œsophagus comes from the thorax through an aperture in the diaphragm and opens into the stomach, which occupies the upper part of the abdominal cavity on the left side, while the liver occupies the right side, both organs being for the most part under cover of the lower ribs. From the stomach comes the small intestine, twenty feet in length, the numerous coils of which fill up the greater part of the cavity. In the right iliac fossa (see Chap. I., p. 31, and Figs 2 and 18) the small intestine passes into the large intestine, or colon, which runs up the right flank to the under surface of the liver (ascending colon), courses across the abdomen under the stomach (transverse colon) to the under part of the ribs on the left side near the spleen, where it turns again, running down the left flank (descending colon) to the left side of the pelvis to end in the pelvic colon or rectum, which opens at the anus, just in front of the coccyx. The organs of generation are situated in the pelvis.

VI. **The Limbs.**—The limbs are covered with the fleshy masses of the muscles which move the various joints. Among the muscles and their tendons run the blood vessels and nerves to the limbs. Large masses of muscle run between the trunk and the upper and lower limbs, and on the back along the spinal column. The fleshy mass of the buttock, for instance, is made up by the strong muscles (gluteal) which move the thigh; and over the upper ribs in front under the breasts are the large muscles (pectoral) which move the upper arm. The thick muscles of the back and flanks hold the body up in the erect position.

VII. **The Skin and Subcutaneous Tissues.**—The body is covered externally by the skin, under which is a layer of fat—the subcutaneous fat, the amount varying in different parts of the body. There is most subcutaneous fat under the skin of the abdomen and thorax, except that in the middle line of the thorax over the sternum there may be little. This layer of fat performs an important function in retaining the body heat, and is well marked in the infant born at full time. In babies born prematurely it is poorly developed, and that is why premature babies must be kept in a warm room or incubator—to avoid the loss of body heat.

VIII. **The Tissues of the Body and their Growth.**—Before leaving the anatomy of the body, it is necessary to explain the *minute structure* of the various tissues of which it is composed. A brick may be considered as the unit of which a building is made, and the "cell" as the unit out of which the body is constructed. But the cells are living, so the body is better regarded as a community of cells in which each has its own duties to perform for the benefit of the whole. The cells of the different tissues and organs have their own characteristics, in accordance with the different parts they have to play in the living machine, but there are certain characters common to most cells. They consist of a minute mass of living substance (protoplasm), with a central core (nucleus), enclosed by a cell-membrane. The red cells of the blood have no nucleus, and the white cells of the blood have no limiting membrane, but they are exceptional. In Fig. 3 the cells of the blood are shown as seen under the microscope after being stained with special dyes. The nuclei of the white cells (*a*) have taken up a blue dye, and appear as a crescentic or skein-like deeply stained centre surrounded by the protoplasm which has taken up a pink dye. One type of white cell (*b*) different from the others is shown with a large round nucleus, not so deeply stained as the others, and the cell protoplasm also stained light blue instead of pink. The oval shape of the nucleus as seen here is more common throughout the cells of the body than the crescentic or other forms. The round red cells show their peculiarity of having no nucleus; their protoplasm has taken up the pink dye, but not so deeply as that of the white cells (*a*).

Space does not allow of more than mention of a few examples of the manifold types of cell in the body. Epithelial cells are those lining the surfaces and cavities of the body, and forming the secreting cells of its glands. The cells of the deep layers of the skin are cubical, but towards the surface or horny layers they become flattened, like the scales of a fish, and are known as "squamous" cells. A squamous epithelium is found on the lips and mouth, and down the gullet as far as the stomach; also lining the vagina and covering the vaginal portion of the cervix. The stomach and intestines and their digestive glands are lined by elongated cells with round nuclei—columnar epithelium—and also the nose, trachea, and bronchi with a similar epithelium, except that in the respiratory tract the cells have fine hair-like processes (ciliated epithelium). In most of the glands (breast, salivary, pancreas), the gland pockets are lined by cells nearly square—cubical epithelium—and the largest gland in the body, the liver, is made up of a mass of cubical cells. The cells lining the peritoneal, pleural, and pericardial cavities and the blood vessels are flattened, fitting together like tiles, and are known as "pavement" epithelium (endothelium). Besides epithelial cells, there are connective-tissue cells, muscle cells, bone cells, nerve cells, all having special characters. Thus the muscle cells have an elongated spindle shape, and their protoplasm has the power of contracting like a piece of stretched elastic; whilst the nerve cells have an irregular angular shape, and are drawn out at their angles into

tendrils or processes, which form the fibres along which the impulses are conducted to and from the cells.

In Fig. 8 may be seen connective-tissue cells, muscle cells, and pavement epithelium cut across in the section of an artery and vein. The thin flat pavement epithelium lining the vessel is seen with dark nuclei at intervals; in the middle coat of the artery are seen muscle cells running round it with their flattened darkly stained nuclei, and outside it fibrous connective-tissue cells.

Like the living creature of which it forms a living unit, each particular cell has its own life-history; its birth by the division of a pre-existing cell into two daughter-cells, growth to maturity and performance of its function by each one of them, and then division again like the parent cell or death and decay. There is thus a constant process of cell-multiplication and cell-decay going on in the body. Till the body attains its full growth, the multiplication of the young and active cells greatly exceeds wastage. After full maturity multiplication slackens, but continues and suffices to repair damage and to renew the tissue-cells as they waste and decay, until old age is reached, when it becomes insufficient, and shrivelling of the tissues occurs. If life is not ended by accident or disease, death of the whole body results when the renewal of the cells in some structure or organ essential to life is no longer adequate to carry on its function. It would appear that the cells have not an indefinite power of division but that a time is reached when that power wanes and finally disappears, the cell afterwards dying and being absorbed and replaced by others.

A short description of the process of cell-division must be given if the essence of reproduction (as given on p. 54) is to be understood.

Before a cell divides, preparatory signs are shown both in its protoplasm and nucleus, but for our purpose those in the latter, particularly those in the fine meshwork that holds the nuclear substance, are the most important. That meshwork contains granules embedded in it called *chromatin* (Greek—chroma, colour), because they colour readily with basic dyes, as shown in the nuclei of (*a*) and (*b*), Fig. 3. Before division the chromatin threads become disentangled from their meshes and wound into long bunches like twisted loops or skeins of wool, somewhat like those shown in (*a*) and similar cells in Fig. 3. They next become shortened and separated out into stick-like bodies, usually bent or bowed into a V- or U-shape. These chromatin bodies, now known as *chromosomes*, are usually arranged in pairs, and are found to take a prominent part in sexual reproduction and in the transmission of hereditary characters. Each chromosome splits into two daughter-chromosomes, one of which moves towards the N. pole and the other towards the S. pole of the cell, the nucleus being now indistinguishable as such. A constriction forms about the equator of the cell, becomes deeper, making the cell hour-glass-shaped, and finally completes the division into two complete but smaller cells, each about half the size of the parent-cell, but with the same number of chromosomes. After division the chromatin aggregated in the chromosomes of each daughter-cell goes through a series of changes the opposite of those before division; they lengthen out, become wound into a skein-form and then into a meshwork containing the nuclear substance, thus re-forming the nucleus. The cells then grow to the size of the mother-cell, perform the same functions, and divide in the same way, the same number of chromosomes being always formed at every division. The number of chromosomes in the dividing cell is the same for every cell in the body and the same for all individuals of the same species of animals or plants, but may vary from 2 or 4 up to 50 or more in different biological groups. In the human species the number of chromosomes is 24. The one type of cell that differs from all the others regarding its chromosome-content is the ripe reproductive cell (gamete), male or female, which has only half the content of the body cells. By the union of the male and female gamete a new cell is produced with the full chromosome content, and thus begins a new individual of that species.

B. PHYSIOLOGY.

By Physiology is meant a knowledge of the functions of the organs and tissues of the body. Only a very brief sketch of the most elementary facts of this wide subject will be attempted—just sufficient to indicate to the pupil midwife the lines on which she can pursue the subject in books specially devoted to it,[1] and to help her to understand and follow the special application of physiology to problems in obstetrics, as well as the principles of hygiene and sanitation as regards home, food, and person (C.M.B. Rules, C 5 (*o*)).

Blood and Lymph.—It is easiest to begin with an account of the fluids which circulate through the body, conveying oxygen and nourishment to all its parts and carrying away its waste products.

The blood is made up of (*a*) the circulating cells or blood corpuscles, and (*b*) a fluid part—the blood plasma—in which the corpuscles float. The cells are of two kinds, the red cells and the white cells or leucocytes.

The red corpuscles are small, round disc-like bodies, which give to the blood its colour, owing to their containing the all-important pigment hæmoglobin, which acts as the carrier of oxygen from the lungs to the body tissues. They are far more numerous than the white cells, and their function as oxygen carriers is so intimately connected with respiration that it is best described under that heading. The white corpuscles or leucocytes are barely 1 to 500 of the red corpuscles, and have entirely different functions. They assist in the repair of the tissues and in preventing the spread of inflammation and infection (p. 27), and may be much increased in number in disease.

[1] *Text-book for Nurses: Anatomy, Physiology, Surgery, and Medicine*, by Hey Groves and Fortescue Brickdale, or *A Nursing Manual for Nurses and Nursing Orderlies*, by Fitzwilliams, will be found to give all the pupil midwife requires.

The blood plasma, or fluid apart from the corpuscles, is difficult to obtain and keep, for as soon as the blood is taken from the body it clots, forming a gelatinous part consisting of fibrin and corpuscles, and a fluid part, the serum. This is a process very similar to the curdling of milk, the fibrin being similar to the curd and the serum to the whey. The serum left after the clot is removed is the watery part of the blood containing the non-clotting albuminous matters, the salts, sugars, and other soluble substances. The midwife has many opportunities of seeing the clotting of blood, and it is well she should understand what it means. So long as the blood is circulating in the vessels it does not clot; but when it escapes from the blood vessels, either in the body or out of it, clotting soon takes place. The fibrin of the plasma forms into a jelly which encloses in itself the cells of the blood and so forms the deep red jelly-like mass known as blood clot. If left alone this clot becomes firm and contracts in size, squeezing out the yellowish serum, and the older it is the firmer it becomes. Thus the ordinary blood clot is blood fibrin and blood corpuscles, and it is to the latter that its colour is due. The clotting of the blood is important in checking the bleeding from small vessels; it is, however, not sufficient to stop the loss of blood from the larger vessels.

As the blood plasma contains many substances dissolved in it which are on their way to and from the various tissues of the body, food substances, such as proteins, fats and sugars, salts and products to be excreted, such as carbonic acid and urea, it might be expected to vary greatly in its composition at different times—as before and after meals, before and after exercise. Owing, however, to the constant excretion by the kidneys of any excess of salts, urea, etc., and to the steady interchange between the tissues and the plasma or lymph which bathes them, of any substances temporarily deficient in the blood, the variations in composition become quite trifling. For instance, the salts are maintained in the blood at about the strength of one drachm of common salt to a pint of water (=a 0·9 per cent. solution of common salt=normal saline solution), and any increase in this is at once passed out by the kidneys, or any diminution is made up by more salt being taken up by the blood plasma from the muscles and organs and other tissues of the body. Similarly, a loss of fluid—by hæmorrhage, sweating, diarrhœa, and so on—will not cause any concentration of the blood unless the loss is so excessive that it cannot be replaced by the fluids withdrawn from the tissues. Whilst this can take place fluid will be taken from the tissues by the plasma, and there will be a greatly diminished excretion of water by the kidneys.

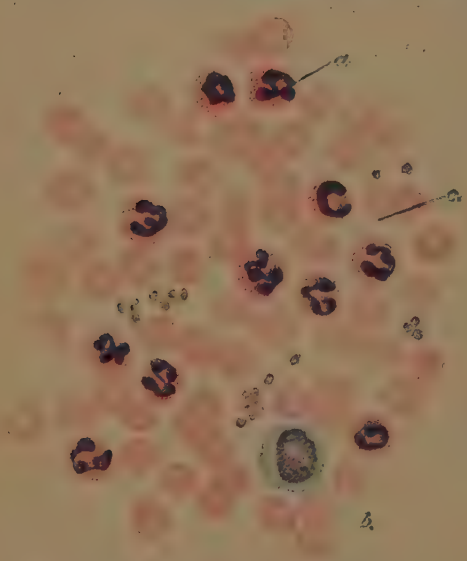


Fig. 3.—The Blood Corpuscles Magnified.

a, *b*. Different varieties of white corpuscles.
c. Red corpuscles.
The white corpuscles have been stained to show their special characteristics. The relative proportion of red and white corpuscles is not correct. An undue proportion of leucocytes are included to illustrate their variations in type.

By this delicate balancing of the dissolved substances the composition of the plasma varies but slightly in health, and is only disturbed by lack of food and water to make up wastage, by excessive losses of blood or other fluids from the body, or by failure of the kidneys to do their work of excretion or of the heart to maintain the circulation effectively.

The total amount of blood is about $\frac{1}{20}$th of the body weight, or on an average about six pints.

The Circulation of the Blood.—The blood circulates throughout the body in tubes or blood vessels, which may be divided into three classes—the arteries, the veins, and the capillaries.

The arteries are the vessels carrying the blood from the heart to all parts of the body. They are composed of an outer fibrous sheath, a middle muscular and elastic coat, and a smooth internal lining; they are thicker-walled and stiffer than the veins. The veins return the blood from the body to the heart, and differ in structure from the arteries in that their walls are thinner, containing very little elastic tissue and much less muscular tissue, so that they are more collapsible and less resistant than the arteries (Fig. 8).

This difference may be illustrated by comparing the arteries to a stiff thick-walled rubber tube, while the veins are like the ordinary thin rubber used for catheters and douche-tubing, which is easily compressible and easily kinked. A further difference, of which more will be said later, depends on the fact that the blood in the arteries, coming as it does direct from the heart, is under considerable pressure, so that when an artery is cut the blood spurts out in a fine rhythmical jet; whilst in the veins, which bring back the dark impure blood from the tissues, the blood is under very little pressure, so that when a vein is cut the blood only wells out. For this reason many of the larger veins are provided with valves to prevent a back-flow of the blood (Fig. 8). The main artery leaving the heart—the aorta—is a very large tube, and from it arise the large arteries—the carotids—passing up the neck to the head and brain, the subclavian arteries going to the arms, the large vessels to the organs in the abdomen, and so on, until finally

it divides at the level of the last lumbar vertebra into the common iliac arteries which run round the pelvic basin, providing vessels for the pelvic organs, and being continued down the legs as the femoral arteries. For the most part the corresponding vein runs alongside the artery (Fig. 8).

As the arteries get farther from the heart they naturally become smaller and smaller. The fine twigs into which they break up are termed "arterioles" or little arteries. Finally, these break up into the fine network of minute vessels, the capillaries, so called, because they are almost hair-like in size (Fig. 9). These capillaries have very thin walls—indeed, no more than the thickness of the lining membranes of the arteries—and they ramify among all the tissues of the body (the organs, muscles, nerves, and bones), and their thin walls allow the fluids, gases, and dissolved substances of the blood to exude into the tissues and bathe them, thus conveying to them oxygen and nourishment, and indeed all that is required for their life and functions. The fluid that exudes to bathe the tissues is known as lymph, and is re-collected by the lymph capillaries passing through the lymphatic glands, finally falling again into the veins. The blood, then, as it passes through the capillaries, gives to the tissues what they require for their nourishment, but it does more in that it takes up from the tissues also the waste products they have formed. One of the most important of these exchanges is the giving up of oxygen to the tissues and the taking from them of carbonic acid, and it is this exchange which causes the difference in colour between the bright red arterial blood going from the heart and the dark bluish venous blood coming back to the heart. This is known as "internal respiration" (p. 13).

FIG. 4.—THE COURSE OF THE BLOOD INTO THE HEART BETWEEN THE BEATS (DIASTOLE).

The arrows show the blood entering the auricle by the vena cava (right side) or pulmonary veins (left side) and passing between the tricuspid (right) or mitral (left) valves into the ventricle. The pulmonary (right) or aortic (left) valves are closed, preventing the blood regurgitating back into the ventricle.

FIG. 5.—THE COURSE OF THE BLOOD OUT OF THE HEART DURING A BEAT (SYSTOLE).

The muscular wall of the ventricle is contracting and driving the blood into the pulmonary artery (right) or aorta (left). The closure of the tricuspid (right) or mitral (left) valves at the auriculo-ventricular opening prevents the blood returning to the auricle, whilst its passage into the pulmonary artery (right) or aorta (left) is permitted by the opening of the valves at the origin of these vessels. Note how the valves are arranged to allow the blood to flow in its proper channel, and compare these figures with Fig. 7, in which the course of the blood on both sides of the heart can be followed.

After the blood has passed through the system of capillaries it is collected again by the very small veins or "venules," and then again by larger and larger veins until it comes back to the heart by the largest veins—the inferior vena cava (from the lower part of the body) and the superior vena cava (from the upper part of the body).

By the force of each beat of the heart the blood is pumped through the arteries till it reaches the capillaries, where naturally, owing to the resistance of these very minute vessels, its pressure is very much diminished and its flow becomes much slower. It then comes back to the heart by the veins under this much diminished pressure with all the impurities and waste products of the tissues. This circulation of the blood throughout the body is generally known as the "greater circulation"; but there is another, the "lesser circulation," which is the circulation from the heart to the lungs and back again to the heart, by which the blood is purified in the lungs before being sent back to the body. The impure venous blood goes by the pulmonary artery to the lungs, is there purified, and returns by the pulmonary veins to the heart, to be pumped again to all parts of the body. A short account of this will be given under respiration, and the way in which other waste matters are got rid of by excretion by the kidneys and liver will also be explained, as well as the processes by which the blood is renewed with nutritive material from the digestive tract.

The Heart.—The mechanism by which the muscular force of the heart keeps the blood moving over the body must now be considered. The heart contains four cavities, two thin-

walled (auricles) at the base and two thick-walled (ventricles) forming the main part of the fleshy mass of the heart. The auricle and ventricle on the left side serve the greater circulation, and the left ventricle is therefore stronger and more muscular than the right, which has only to force the blood through the lesser circulation. The openings from the auricles into the ventricles and the openings from the ventricles into the aorta and pulmonary artery are provided with valves to direct the blood current in the proper direction. The course of the blood through the heart is as follows (Figs. 4, 5, and 7) :—

The impure venous blood from the body flows into the right auricle by the superior and inferior venæ cavæ and is driven by the contraction of the auricle into the right ventricle. When the ventricle contracts the blood in its cavity is forced out through the pulmonary artery to the lungs, its passage back into the auricle being checked by the closure of the valves (tricuspid) at the auriculo-ventricular opening. In the lungs the blood is aerated by taking up oxygen and giving up carbonic acid, and returns by the pulmonary veins (which, unlike all other veins, carry red arterial blood) to the left auricle. From the left auricle the blood passes into the left ventricle, from which it is forced by the contraction of its muscular wall into the aorta, its passage back into the left auricle being prevented by the closure of the mitral valve. Thus with each beat (systole) of the heart blood is forced into the lungs and into the body, and during the time of rest or relaxation (diastole) between the beats the blood is prevented by the pulmonary and aortic valves from regurgitating back into the heart whilst its chambers are being refilled from the veins. Each beat of the heart, which occurs about seventy-two times in the minute, forces a ventricle-full of blood into the already full arteries, and that causes a sudden distension of the whole arterial system which can be felt as the **pulse** in any artery of the body. The radial artery at the wrist where it passes over the bone at the base of the thumb is generally used as the place to feel and count the pulse, as at this point it is easy to feel the distension of the artery by the heart-beat between the finger and the bone, but the same thing can be noticed in any artery not too deeply placed. It will now be obvious why the pulse beat varies under different conditions of health and illness. During active exercise more oxygen is required by the muscles of the limbs and more carbonic acid is produced by them, and in order to provide for this a greater flow of blood is necessary, so that the heart beats faster, and therefore the pulse-rate becomes faster. Breathing is also quickened so that the extra oxygen may be obtained and the extra carbonic acid got rid of. The stronger the beat of the heart the stronger the pulse. After hæmorrhage, when much blood has been lost, the heart has to beat faster to supply enough blood for the needs of the body, and therefore the pulse-rate becomes faster and at the same time the beat is smaller because less blood is forced into the arteries at each beat, and therefore the distension of the arteries is less. When the hæmorrhage has been dangerous in amount the pulse-beat becomes so small and so fast that it can scarcely be counted, and the pulse is then described as "running." The importance of watching the pulse as an index of the state of the heart and circulation generally will thus be easily understood.

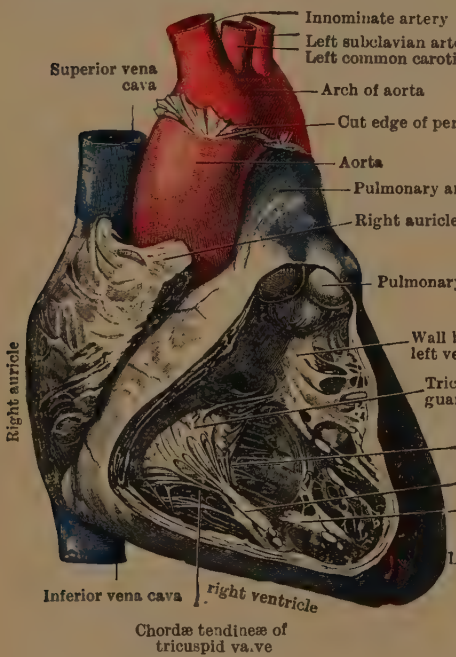


FIG. 6.—THE HEART WITH THE RIGHT VENTRICLE LAID OPEN TO SHOW THE VALVES.

The innominate artery divides into the right common carotid and subclavian arteries.

[Vessels carrying arterial blood coloured red; vessels carrying venous blood coloured blue.]

Regulation of the Blood Flow.—The supply of blood to any part of the body is regulated by the state of contraction or dilatation of its arterioles. The coats of the smaller arteries are almost entirely muscular, and when, through the influence of the nervous system, the muscular walls contract, the size of the vessels and therefore the blood supply are diminished. For instance, when a person turns pale, the muscular walls of the small arteries in the face contract, the supply of blood is cut off, the capillaries are emptied, and the cheeks and lips become blanched. On the other hand, in "blushing," the small arteries going to the cheeks relax and dilate and thus allow the capillaries to fill with blood, causing reddening of the cheeks. This power of the arterioles to control the blood supply to the capillaries is of prime importance in health and in

disease and requires further explanation. The degree of contraction or relaxation of the muscular walls of the arterioles, by which the blood supply to any organ or part of the body is determined, is varied by messages or impulses from the brain and spinal cord, through a special set of nerves to these vessels—the *vasomotor nerves*. The nerves which cause contraction of the muscular coat and so constriction of vessels are known as the *vasoconstrictor* nerves, and those which cause the muscular walls to relax and so produce dilatation of the vessels are known as the *vasodilator* nerves. Owing to this intimate relation between the central nervous system and the muscular coats of the arterioles through these vasomotor nerves, it is easy to understand how emotional causes can influence the flow of blood to the cheeks and lips, such as occurs, for instance, during blushing. The face flushes under some emotional cause, because a sudden impulse from the brain through the vasodilator nerves produces dilatation of the arterioles of the face, a greatly increased supply of blood to that part, and, in consequence, a flushing with blood of all the small capillaries of the cheeks and lips. On the other hand, under other emotions, such as sudden fear or shock, the opposite effect occurs, and there comes from the brain by the vasoconstrictor nerves an impulse which causes constriction of the vessels and a great diminution of the blood supply, causing a corresponding check to the capillary circulation and thus blanching of the lips and cheeks. Other emotional effects caused through the vasomotor system may be mentioned, as the nervous diarrhœa caused by flushing of the intestines with blood owing to dilatation of their vessels, and the large quantity of watery urine passed after strong emotion, caused by an excessive secretion due to the rush of blood through the kidneys.

These examples are given as easily understood instances of the results of the control of the blood supply through the nervous system, and not because they are in themselves important. The same process occurs during the physiological activity of any organ of the body, so that in, say, the stomach during digestion, the vasodilator nerves allow an increased supply of blood to flow there, and when the stomach is empty and at rest the vasoconstrictor nerves cause a diminution of the blood supply. Another very good example of vasomotor action is afforded by the regulation of the blood flow to the surface of the body according to the external temperature. During hot weather or by a hot bath, the arterioles of the skin are dilated, and so allow the capillaries to fill with blood, causing the whole surface of the body to become flushed; during cold weather or by a cold bath, the walls of the arterioles are constricted and the supply of blood to the surface capillaries is cut off, causing pallor of the surface and later blueness, owing to the deficient oxygenation of the tissues from the restricted circulation of arterial blood. This action

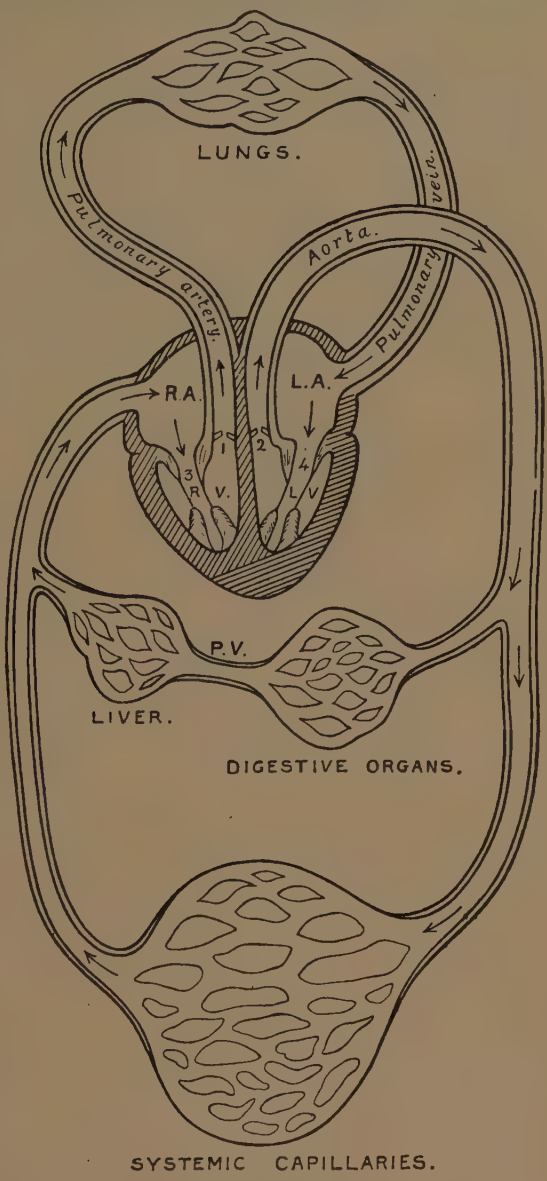


FIG. 7.—SCHEME OF CIRCULATION.

R.A. Right auricle.	1. Pulmonary valve.
L.A. Left auricle.	2. Aortic valve.
R.V. Right ventricle.	3. Tricuspid valve.
L.V. Left ventricle.	4. Mitral valve.
P.V. Portal vein.	

Above the heart is the "lesser circulation," below the "greater circulation." The blood from the digestive organ is collected by the portal vein, P.V., and breaks up again into capillaries in the liver before returning to the heart. This is referred to on p. 17.

will be seen to be a very important one in regulating the loss of heat from the body. Use is made of this mechanism for controlling the local blood supply in treatment of injuries and diseases by the application of heat or cold to the affected part. When ice or a cold compress is applied to a sprain, its action is to constrict the vessels, and by diminishing the blood flow, to prevent the swelling and effusion of fluid which follow the increased blood flow. When heat is applied in the shape of a fomentation, it causes an increased flow of blood and a flushing of the vessels. The congestion which occurs as the result of injury or inflammation of any organ or part of the body is caused by a relaxation of the arterioles and a flushing of the capillaries with blood, but from the midwife's point of view perhaps the most important consequence of this nervous influence on the small arteries occurs in connection with the production of *shock* or *collapse* following severe injury or loss of blood.

"Shock" is the result of a paralysis of this nervous mechanism in consequence of which marked dilatation of the arterioles of the abdominal region is produced, and so much of the blood of the body collects there that too little is left for the needs of the brain and spinal cord and sufficient blood does not return to the heart to keep the circulation at its proper strength; hence the pallor and coldness of the surface of the body and the smallness and feebleness of the pulse. Thus even a strongly acting heart may fail because it is not supplied sufficiently with blood. If in addition to this vasomotor paralysis there is added an actual loss of blood from hæmorrhage, the extremely dangerous nature of the case will be plain.

From what has been said it will now be clear that the arteries are kept in a state of distension by the blood pumped into them by the heart, and that this state of distension can be varied by the contraction or relaxation of the walls of the arterioles under the control of the vasomotor

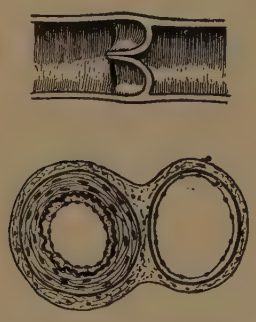


FIG. 8.—STRUCTURE OF BLOOD VESSELS.

Above, a vein showing valves. Below, a cross-section of an artery and its accompanying vein, to show the difference in the structure of their walls. The thick-walled artery has an outer fibrous sheath, a thick muscular coat with elastic fibres, shown by their zigzag outline and a smooth inner layer. The thin-walled vein has an outer fibrous sheath like the artery and a smooth inner lining, but the middle muscular and elastic coat is extremely thin.

FIG. 9.—DIAGRAM OF CAPILLARY CIRCULATION.

The lower arrow shows the blood entering the capillary network by a small arteriole. The blood after passing through the thin-walled capillaries is collected into a minute vein, and as shown by the upper arrow is returned to the heart.

system. The blood in the arteries is therefore at a considerable pressure (=the blood pressure), and while this pressure is kept fairly constant, the varying needs of organs and other parts of the body are provided for by local changes in their vessels. These local changes are either too slight in amount or are compensated for by a change in the opposite direction elsewhere, so that the general arterial pressure of the body scarcely varies. There is a trifling daily variation in blood pressure corresponding to that of the temperature and pulse; rest lowers it, while excitement and exercise raise it; cold raises it, warmth lowers it; and so on. But all these variations are temporary, the pressure soon being regulated to what is normal for the individual by some relaxation of the constriction of the small arteries or by some compensating change in the heart's action, which is also under nervous control from the brain. The blood pressure tends to rise with age, because the arterial walls become stiffer and do not relax so well as in youth; so much is this the case that the expression "a man is as old as his arteries" means that a person of eighty with arteries as supple and elastic as is usual in a person of fifty may live to a hundred, but a person of fifty with stiff and hard arteries and a high blood pressure is not likely to live to sixty. The higher the blood pressure, the harder the heart must work to force the blood from the left ventricle into the arteries against this pressure. Therefore a high blood pressure is a great strain on the heart, and there is also the risk that if the vessel walls are weak anywhere, the high pressure will burst them (this generally occurs in the brain and causes an apoplectic stroke) or make them bulge out at the weak spot (this generally occurs in the aorta or big arteries and is known as aneurysm), just as may happen in a rubber tube when there is too great pressure of water inside.

A very low blood pressure is much less common, though nature endeavours to keep the blood pressure at the lowest at which the circulation can be properly maintained. As explained above, shock and collapse are produced by the great fall of blood pressure due to a complete

relaxation of the vast arterial system of the abdomen. When the blood pressure is high, the pulse at the wrist feels hard and the beat is not easily stopped by pressure with the finger; when the blood pressure is low, the pulse is soft and compressible and slight pressure with the finger will stop the beat.

Before leaving this very important matter of the circulation it will be well to illustrate some points in regard to the capillary circulation. The resistance of the arterioles and the very fine and extensive network of capillaries (for diagram illustrating this see Fig. 9) is so great that the flow of blood through this network is slow, and the rate of flow will depend chiefly on the strength of the heart-beat and on the amount of resistance to the blood making its way from the capillaries into the veins. The effect of the want of sufficient driving power from the heart is quite clear, but the second factor, increased pressure in the veins, is not quite so evident. Suppose a garter is put round the leg just below the knee and tightly enough to cause pressure on the thin-walled veins. This will cause the outflow of the blood from the leg to be impeded, so the blood will be dammed back into the veins. As the veins become distended it will be more difficult for the blood to get from the capillaries into the overfull veins, and this will further slow the current in the capillaries and will increase the pressure of blood in them. This will cause the foot to become cold and blue, and will also give rise to an increased amount of the fluids of the blood passing into tissues of the leg below the garter—in other words, to swelling and dropsy (œdema). A local venous congestion like this illustrates what happens when a general venous congestion is caused by heart disease, blocking the return of the blood to the heart, for the blood will then tend to stagnate in the capillaries and so cause coldness, blueness (cyanosis), and dropsy of the extremities.

In order to give the pupil a proper perspective of the circulation as a whole it may be well to direct her attention still further to the important place occupied by the capillaries. Because they are minute vessels unrecognizable by the naked eye, it must not be thought that their importance is to be estimated by their insignificant appearance in the background of the picture. It is exactly the reverse. The capillary circulation is really **the** essential part of the whole circulation, the part that all the rest is arranged to serve. The blood is the medium which carries the material to be burnt up in the body and brings back the products of combustion to be got rid of; the heart is the pump which drives the blood round the body; the large arteries are the pipes to carry the blood, and the smaller arteries and arterioles are the taps to regulate the flow as so to keep the capillaries supplied according to the need for the time being of the various organs and tissues. In the capillaries the whole function of the blood is carried out, namely, the giving to the tissues of what they require and the taking away of what they do not require. The veins are merely the pipes returning the used-up blood to the heart. More than this, the capillary circulation will be seen to be adapted in each organ or structure to serve the specific functions which that organ or structure has to perform. Through the capillaries in the air-cells of the lungs exchange of gases takes place (respiration); through those of the intestinal mucous membrane food material is absorbed into the blood (absorption); through those of the liver the modification of absorbed food material and waste products is effected; through those of the kidney the excretion of waste nitrogenous matter is carried out; and through those of the brain and spinal cord, of the bones, muscles, and other tissues, material is given out to be used up in their growth and in carrying on their functions, and the waste produced thereby collected and removed. (Compare description of capillary circulation in the placenta, p. 63–4.)

Respiration.—In regard to respiration, there are two important matters for consideration: (1) the mechanism by which air is drawn in and out of the lungs; and (2) the processes by which the exchange of gases between the air in the lungs and the blood in the capillaries is brought about.

(1) *The mechanism of the respiratory movements* is a simple mechanical problem. The lungs form two elastic bags contained in a closed cavity, the thorax. When this cavity is expanded, the air comes in by the windpipe to the lungs and inflates them, and when the cavity is diminished in size the air is forced out. There is thus a tide of air in and out of the lungs, the tide flowing in with the expansion of the chest (inspiration) and flowing out with the falling in of the chest (expiration).

The expansion of the chest in inspiration is brought about by the elevation and separation of the ribs of the two sides and by the widening of the spaces between the individual ribs (termed thoracic breathing), and also by the lengthening of the cavity by the descent of the diaphragm, which in so doing pushes down the liver, stomach, and other abdominal organs (termed abdominal breathing). These two forms of breathing can be observed—the thoracic by the rise and fall of the chest, the abdominal by the rise and fall of the abdominal wall. The thoracic form of breathing is rather more marked in women than in men (owing largely to the restriction of the abdominal movements by the wearing of corsets), and especially is this the case during pregnancy, when the pregnant uterus takes up so much room in the abdomen that it interferes with the full descent of the diaphragm. Hence if the breathing of a woman in the later months of pregnancy is observed, the thoracic type of breathing is plainly shown by the marked up and down movements of the breasts.

The respiratory movements are brought about by the muscles of respiration—the intercostal muscles, which widen and close the spaces between the ribs, the muscles of the diaphragm, the muscles of the abdominal walls, and so on. The muscles which are used in quiet breathing, or the *ordinary* muscles of respiration, may be reinforced by other muscles, the *extraordinary* muscles of respiration, in cases of special effort or difficult breathing. As these extraordinary muscles are used during "bearing down" in the second stage of labour it is important that the pupil should have some knowledge as to how these muscles are brought into use.

The extraordinary muscles of respiration are those muscles which can be used to help in the expansion of the chest, though this is not their usual function. For instance, the large pectoral muscles which lie on the front of the chest and pass along the fold of the armpit to the shoulder, and whose ordinary action is to move the shoulder and arm, may, if the shoulder is fixed, help to open the chest. Similarly, the muscles running down the neck from the head to the breast-bone (sternum) which ordinarily move the head, may, if the head is fixed, help to raise the sternum and so expand the chest. The muscles of the abdomen and flank, which run from the chest to the pelvis, may also act as expiratory muscles if the hips and pelvis are fixed. In other words, the muscles which are attached to the chest at one end and to the shoulders and head at the other, and which ordinarily move the shoulders and head, may, when the head and shoulders are fixed, cause some movement of their other point of attachment, the chest. Such use of the extraordinary muscles of respiration may be seen in cases of extreme respiratory distress (as in serious disease of lungs or heart) when the patient sits up in bed gasping for breath (orthopnœa) with the head thrown back and fixed and the arms grasping some object to fix the shoulders. These additional respiratory muscles are also brought into action during a bearing-down effort in the second stage of labour. To get the greatest amount of power possible the patient has her feet against the end of the bed, or something she can press against, like a rower against the stretcher of the boat; by this means she fixes her hips. In her hand she holds a towel, tied to the end of the bed, so that she can fix her shoulders. She then takes as deep a breath as she can, and by fixing her shoulders and head uses all the extraordinary muscles of inspiration to expand her chest to the utmost; she then holds her breath by closing the glottis (p. 3), and with her hips and pelvis fixed, by pressing firmly with the feet against the end of the bed, brings into action all her extraordinary muscles of expiration—and especially the abdominal muscles. But because the air cannot escape from her chest, owing to its way out being closed at the larynx, this raises the pressure in the chest and abdomen, and the increased abdominal pressure helps to force down the uterus and child. If such a bearing-down effort is very strong and sustained, the patient's face may be seen to get quite dusky—" black in the face " as it is popularly termed. This is due not only to holding the breath, but to the great pressure in the chest obstructing the return of the blood by the veins from the head into the chest.

(2) *The Exchange of Gases in the Lungs.*—The processes by which the exchange between the air in the lungs and the blood is effected form too difficult and complicated a question for more than a very elementary explanation. The lungs form a structure similar to a honeycomb, and in the very thin walls of each cell (or alveolus) the blood pumped there from the right side of the heart circulates in a vast network of fine capillaries. The air is drawn into these cells with each inspiration, so that the blood circulating in the capillaries of the cell wall is separated from the air in the cell cavity by little more than the very thin wall of the cell and the even thinner wall of the capillary vessel. So fine are these membranes separating the blood from the air that an exchange of gases between the two can take place, and, by the active participation of these membranes in effecting the exchange, is even greater than would occur if the blood was actually exposed to the air. In order that the student may realize what an enormous area of blood in very thin layers is thus exposed to the action of the air, it may be explained that the spongy mass of the lungs is made up of millions of these cells with their thin walls and that the network of capillaries in the walls is so extensive that it is almost as if a very thin layer of blood was spread out over each cell. It has been calculated that the total area of the lung cells is one hundred times greater than that of the surface of the body, and if this is kept in mind it will be evident that, with a thin layer of blood spread over so large a surface, it will not be difficult for a very considerable interchange of gases to occur.

Pure air consists of oxygen and nitrogen, but only one-fifth is oxygen, the remaining four-fifths being nitrogen; the nitrogen of the air is not absorbed at all, it simply dilutes the oxygen and is itself inert. That is why in some illnesses, as in pneumonia, where large sections of the lung cells are filled up with inflammatory matter so that the absorbing surface is greatly diminished, or in extreme bloodlessness, where there is little blood to absorb oxygen, additional oxygen is administered from a cylinder of the pure gas.

But besides taking up oxygen from the air the blood also gets rid of the waste gas and of a certain amount of water vapour. This waste gas is carbonic acid (the same substance as is formed by burning coal gas, oil, and so on), which is formed in the body by the combustion of food substances.

The oxygen is taken up from the air by the hæmoglobin, the colouring matter of the red corpuscles. In the venous blood going to the lungs, the hæmoglobin is dark in colour, but after passage through the lungs it becomes bright red (oxy-hæmoglobin), owing to its having combined with oxygen. The oxy-hæmoglobin liberates part of its oxygen to the tissues, and the blood returns by the veins of a darker colour until it is oxygenated again in the lungs. The hæmoglobin has the property of combining with other gases besides oxygen. For example, " laughing gas " (nitrous oxide), used so much by dentists as an anæsthetic in extracting teeth, and by the surgeon in operations where a short anæsthetic is required, combines with hæmoglobin and forms a much darker coloured body than oxy-hæmoglobin, and that is why a patient under gas becomes so livid in colour. Another gas which combines with hæmoglobin is one of the gases in coal gas and formed in the partial combustion of coke, petrol, and other carbon compounds. This gas (carbon monoxide) forms a stronger combination with hæmoglobin than oxygen and so prevents the hæmoglobin acting as an oxygen carrier, and it is in this way that death is caused in poisoning by coal gas. The carbonic acid in the blood is not carried by the hæmoglobin but by the carbonate of soda which is dissolved in the blood plasma. The salt takes up extra carbonate

acid in the tissues, becoming bicarbonate of soda, and in the lungs gives up the excess of carbonic acid to the inspired air and returns from the lungs in the red arterial blood as carbonate of soda, ready to repeat the process of taking up more carbonic acid in the body. The pupil must remember that the oxygen is used up all over the body when and where it is required ; that the chemical combustion in the body takes place not in the lungs but in the tissues themselves (internal respiration), and that the lungs are merely the place of entry and exit for the gases required for, and resulting from, the chemical processes of the body, and that the blood is the carrier of these gases between the lungs and the body tissues. Further reference will be made to this internal combustion when the question of the production and maintenance of the heat of the body is considered.

From what has been said in regard to respiration it will be clear that expired air contains less oxygen and more carbonic acid and water vapour than inspired air, and that the air of ill-ventilated and crowded rooms will become vitiated by the increased percentage of expired air it contains.

Food.—Besides air and water, the body must be supplied with food to carry on its manifold functions, for the growth and repair of its tissues, and as fuel to do its work as an engine. It is, therefore, important to have some idea of the nature and composition of the various food stuffs, so that we can judge of their value as fuel and try to find out what is best. Roughly speaking, food material may be divided into three classes—(1) protein or flesh-forming, (2) carbohydrate or sugary and starchy foods, and (3) fats.

(1) The proteins are found chiefly in cheese, meat, fish, etc., but there is also a certain amount of protein present in vegetable foods, especially peas, beans, and lentils. Protein consists of carbon, hydrogen, and nitrogen, and a certain amount of protein is an essential constituent of any diet. There is no nitrogen in the other classes of food, and a certain amount of nitrogen is required to support life, so for this reason some protein is necessary to prevent starvation. The carbon when burnt becomes, with the oxygen taken in, carbonic acid (or carbon dioxide), and as such is got rid of from the lungs during expiration. The hydrogen when burnt becomes water (which is hydrogen and oxygen), and is got rid of by the kidney, the skin, and in the breath. The nitrogen is excreted by the kidneys, mainly as urea. A protein or albuminous diet would supply all the necessary constituents to sustain life, but it would have to be taken in such large quantities that there would be too much nitrogen for the body to get rid of easily and a severe strain would be thrown on the liver and kidneys ; and further, it is the most expensive form of food and would therefore be doubly wasteful.

(2) The sugary and starchy foods, or carbohydrates, are very valuable to the body, and if sufficient nitrogen is supplied by the addition of a certain amount of protein food a great saving of the excretory functions is effected. The carbohydrates contain only carbon and hydrogen, and if they are burnt in the body into carbonic acid and water a great deal of heat and energy is produced, and in this way much of the more expensive protein food is saved. Also the body can store up the carbohydrates by converting them into fats or hydrocarbons, a different combination of carbon and hydrogen, and use this stored-up fat in time of need. Sugar, rice, arrowroot, potatoes, and such-like are nearly pure carbohydrates, but most of these foods as found in nature contain a small quantity of protein or albuminous material also.

(3) Fats or hydrocarbons, another combination of carbon and hydrogen, are found in animal flesh, in milk, and in certain vegetable foods. They are very valuable to burn to produce heat ; hence large quantities are required by those living in arctic regions and in cold climates generally. The " blubber " consumed by the Esquimaux is a good instance of the use of fat as a heat-producing food. Fat is therefore very valuable to burn and save the more expensive protein food.

Water and salts, lime, iron, and other bodies which are necessary for the body are not classed as foods. Nor are the various condiments which are taken to make food palatable. Also there are accessory substances in food termed vitamins the precise nature of which is not understood, though their absence from the diet is known to result in grave disorders of nutrition. Vitamins are present in minute quantities but are destroyed by sterilization and other means of preserving food, so that those fed too exclusively on preserved foods are liable to such diseases as scurvy, rickets, or beri-beri, though the deficiency can be made good, and these diseases prevented, by small quantities of fruit juice or fresh meat juice. It is therefore important that the pregnant woman, nursing mother, and bottle-fed baby should have a diet well provided with vitamins. Fruit, green vegetables, fresh meat, cod-liver oil, fresh cream, and butter are well provided with these elements. It is interesting to note that summer butter, from grass-fed cows, is rich in vitamins, whilst winter butter, from stall-fed cows, is poorly supplied. A practical application is the giving of fruit juice and meat juice to babies fed on sterilized or dried milks to counteract the tendency to scurvy and rickets.

Many of the actual food stuffs which we use contain all three classes of food here described, and we could not choose a more instructive instance than that of milk. The composition of the human milk and the milk of animals varies somewhat, so we will take cow's milk as the one in most general use as a food. Cow's milk contains about 87 per cent. of water, 4 per cent. of protein (curd and soluble albumin), 4 per cent. of fat (cream and milk globules), and 4½ per cent. of milk-sugar (lactose), with a little of salts and other bodies. Hence it not only contains all the classes of food already described, but the water and salts necessary for the body, and so by itself can support life, adult as well as infant. There is sufficient nitrogen in the protein for the requirements of the body, and without nitrogen starvation would result. That is, no amount of carbohydrate (lactose) and fat (cream) would make up for the want of nitrogen-containing protein, and the proteins of the body would be called on to provide the necessary nitrogen, and so wasting and

ultimately death from starvation would result, as is the case if more nitrogen is excreted than is taken in with the food. In the adult there is nitrogenous equilibrium, *i.e.* the amount excreted

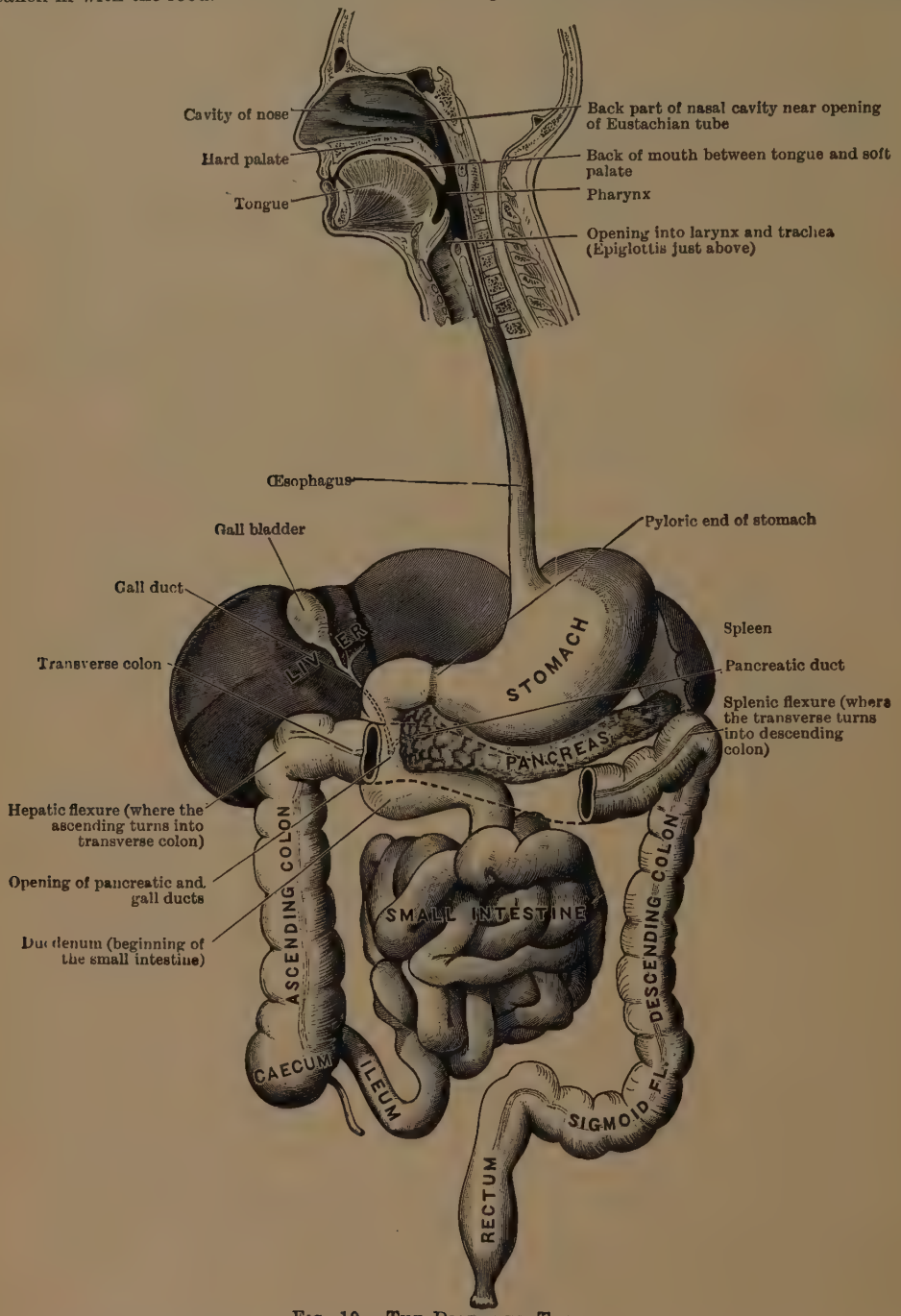


FIG. 10.—THE DIGESTIVE TRACT.

The liver is turned up to show the gall-bladder and gall-ducts on its under surface and the pyloric end of the stomach and duodenum which it covers.

The transverse colon has been cut away to show the duodenum, but its course is indicated by dotted lines. The vermiform appendix is seen hanging down from the cæcum. The loop of large intestine which precedes the rectum is marked "sigmoid flexure," and includes the iliac colon and the greater part of the pelvic colon.

is practically equivalent to that taken in in the food, that retained representing only what is necessary to repair tissue waste. In the growing child and youth, nitrogen is retained, *i.e.* less

is excreted than is taken in, for the formation of new tissue, itself largely protein in composition. It will be seen later (p. 68) that the pregnant woman also retains nitrogen both for herself and for the developing fœtus. A milk diet gives us nearly equal quantities of protein, fat, and carbohydrate, a mixed diet in which there is more than sufficient protein to provide the all-necessary nitrogen. Were the protein increased, however, that would be no advantage, as too nitrogenous a diet means an excess of nitrogenous waste products—urea, uric acid, and the like—so that the human engine would be clogged with the waste matters produced by the over-rich diet. The carbohydrate and fat are easily absorbed, easily stored up for future use, and easily burnt up to produce heat and muscular energy without over-production of waste matter.

The fuel or caloric value of food, *i.e.* its power of producing energy, is estimated in calories, one calorie being the amount of heat necessary to raise the temperature of one litre of water 1° C. One ounce of protein and carbohydrate have about the same caloric value, 120, whilst an ounce of fat has more than double or over 250 calories. An ounce of breast milk and cow's milk each represent nearly 22 calories, and an ounce of humanized milk rather under 20 calories. As a baby requires about 50 calories a day for each pound of body weight, these caloric values are sometimes useful in calculating the amount of food a child of a given weight should have.

Digestion and Absorption.—Digestion is the process by which the elements of the food are altered and prepared so that they can be absorbed into the body and used there.

The solid part of the food is first broken up into a state of fine division by the teeth ; it is then moistened by the saliva, which has a digestive action on the starchy portions, passed down the gullet or œsophagus by swallowing, and so reaches the stomach. If the food is not broken up into very small pieces by thorough chewing, the larger portions escape digestion and cause irritation. This is why defective teeth and bolting the food are common causes of indigestion.

The stomach acts partly as a reservoir to collect and prepare the food before passing it on to the intestine and partly by commencing the digestion of some parts of the food.

Its reservoir action enables us to take considerable quantities of food at a time. Its capacity varies in different individuals, and, naturally, also according to the period of life. In the newborn infant an ounce to an ounce and a half is its average capacity, and in the adult it will contain two to four pints.

When food enters the stomach it excites the secretion of the acid gastric juice by a nervous mechanism, and the food is thoroughly mixed with this juice by being moved round and round by the muscular walls. The gastric juice is an acid secretion with a slight antiseptic action ; it prevents fermentation, and it also contains an important digestive juice—pepsin. By the action of the acid and the pepsin it partially digests the albuminous part of the food. The gastric juice also contains another substance called rennet, which curdles milk. The rennet which we buy for the purpose of making junket is, in fact, extracted from the stomach of the calf. The connective tissue enclosing the albuminous parts of fleshy food and containing fatty matter in its meshes, and the envelope of cellulose containing the proteins and starches of vegetable food, which are partly broken up during cooking and mastication, undergo further disintegration by the action of the gastric juices and thus liberate the essential parts of the food for digestion.

The fluid resulting from digestion in the stomach is known as chyme. It is passed on at intervals to the intestine, so that in about four hours after a meal the stomach is empty. As soon as this chyme reaches the first part of the intestine (the duodenum) it is mixed with the bile which comes from the liver through the bile duct, and with the secretion from the pancreas, the chief digestive gland. The bile helps the digestion of fats, but has not so important an action as the pancreatic juice, which is the most important of all the digestive juices. The pancreatic secretion is alkaline, and its active principle (trypsin) completes the digestion of the albuminous material begun in the stomach, and carries out the digestion of the fats, sugars, and starchy matters which are not affected by the gastric juice. It is assisted by the secretions of the small intestine (succus entericus). The chyme in the small intestine is at first of a greenish colour from the admixture of bile, but further on it becomes yellow and is of the consistence of pea soup.

The contents of the bowel are moved on by the contractions of its muscular coat. These contractions pass down the intestine with a wave-like action—the bowel constricting itself above the food and relaxing below—so that the action is very like that of squeezing out the contents of a tube by pressing the fingers down the outside of the tube. This progressive squeezing action of the intestine is known as " peristaltic action " or " peristalsis." Digestion, then, goes on while the food is slowly passing down the twenty feet of small intestine, and with it the absorption of its digested and nutritive parts. Before it can be absorbed the food is reduced to a liquid state and, except for the fats, brought into solution. By the peptonizing action of the digestive juice the proteids are dissolved, mainly as " peptones " ; the insoluble starchy carbohydrates are converted into soluble sugars, chiefly by the pancreatic juice, and are absorbed as such together with the soluble sugars taken with the food. The fats are brought into a state of minute division so as to form a creamy liquid or emulsion by the combined action of the pancreatic juice and the bile.

Absorption.—This takes place through minute finger-like projections of the intestinal lining membrane, the villi, which are so numerous as to give it a velvety surface. The emulsified fats are absorbed into the lymphatic vessels (the lacteals) as a milky-like fluid (chyle) which is finally passed into the veins, while the other products of digestion, the peptones and sugars together with soluble salts, are absorbed direct into the veins of the intestines by the capillaries of the villi. By the time the contents of the small intestine reach the large intestine (or colon) nearly 90 per cent. of the nutriment of the food has been taken up, but there has been little diminution in the

quantity of water and its consistence is still that of pea soup. In the colon the absorption of water takes place—indeed this is the chief function of the large intestine—and the bowel contents gradually become more and more solid, until in the descending colon they are about the same consistence as normal fæces. This capacity of the large intestine to absorb water is frequently made use of in the treatment of shock after hæmorrhage by the injection of dilute salt solution into the rectum, and sometimes patients are fed by the injection of nutritious and artificially digested foods into the bowel. In connection with feeding by the rectum, it is well to remember that sugars are best absorbed by the large intestine, digested albuminous matter much less readily, and fats scarcely at all. Owing to the presence of a valve (the ileo-cæcal valve) at the junction of the small intestine with the large, which prevents matter returning from the large to the small intestine, any injection given by the rectum fails to reach the small intestine under normal conditions.

The large intestine, then, is to be looked upon, like the stomach, as a reservoir, in which the unabsorbed remains of the food are collected and become more solid by the absorption of water, so that though material is constantly passing into it from above it is only emptied at intervals of about twenty-four hours, when the rectum, the lower part of the bowel, becomes filled and provokes the desire to evacuate its contents. In this respect the colon plays a similar part in the digestive tract to the bladder in the urinary tract. The fæces are normally formed somewhat in the shape of the bowel and consist of the unabsorbed remains of the food and the residue of the digestive juices. Their colour is due to altered bile-pigment, and their odour to putrefactive changes set up by the extensive bacterial flora in the colon.

The anus, the outlet of the large intestine, is closed by a ring of muscle, the sphincter ani, which is relaxed during the act of *defæcation* or the emptying of the bowels. The evacuation of the bowel is effected in the following way. The fæcal matter is passed by the peristaltic action of the descending colon into the rectum, and then by a straining effort in which the pressure is raised in the abdomen by taking a deep breath, holding it and contracting all the abdominal muscles, the contents of the rectum are forced down, the sphincter muscle being relaxed and the lower end of the bowel drawn up over the fæcal mass by the levator ani muscle.

As it contains all the essential food substances, the digestion and absorption of milk may be taken as a summary of these processes and will form a useful lesson to the midwife. Milk passes so rapidly through the mouth that it is unaffected till it reaches the stomach. There it undergoes two changes. The rennin (the essential part of rennet) coagulates the caseinogen, producing a thick curd, containing in its substance much of the fat; solution of this curd by the pepsin then begins, and, when the contents pass into the intestine, is continued by the trypsin till the insoluble casein and the soluble lactalbumin are converted into soluble peptones. These peptones are then absorbed through the capillaries of the villi of the small intestine into the intestinal veins, and then by the portal vein reach the liver, where they are modified and passed into the general circulation by the hepatic vein, which joins the inferior vena cava. The carbohydrate is already in solution as milk-sugar, and is absorbed, as all the sugars are, by the same route as the peptones. The fat in the milk is in a state of division into minute globules, but much of it is enmeshed in the curd formed in the stomach. This is, however, liberated again by the digestion of the curd, and with the rest of the fat is absorbed as an emulsion by the lymphatics of the intestinal villi, collected into a small reservoir, the receptaculum chyli, lying on the front of the second lumbar vertebra, from which it passes by the chief lacteal duct, the thoracic duct, up the front of the vertebral column to open into the veins at the root of the neck near the origin of the superior vena cava. The soluble salts follow the same route as the peptones and sugars. Under normal conditions in the adult little of the milk will escape digestion and absorption. In the infant there is always some undigested matter, largely curd and fat, which, together with the bile and residual juices from the digestive tract, forms the motion.

In addition to this general account of the functions of the stomach and intestines there are certain special points relating to normal and abnormal conditions of the digestive canal to which the pupil's attention ought to be directed because of their bearing on her practical work.

From what has been said as to digestion in the stomach, it is evident that fluids will be passed out of it sooner than solids, and warm fluids about the temperature of the body more rapidly than very hot, or still more so than very cold. Gruel or "slops" will pass out almost as quickly, but it must not be forgotten that certain fluids, milk, for instance, are partly solidified by the curdling action of the gastric juices. Indeed, as already stated, precisely the same change in milk occurs in the human stomach as happens when rennet, the secretion of the calf's stomach, is added to warm milk, in making junket. The passage of this curd from the stomach will, therefore, be delayed beyond that of the fluid portions. Boiled milk, milk diluted with barley water, and especially peptonized milk (*i.e.* partly digested milk), form smaller masses of curd and hence are more rapidly got rid of. Raw egg is easily digested and brought into solution; boiled egg, *i.e.* with the albumin coagulated, with more difficulty, and this is why the firm hard-boiled egg is less easily digested, but the smaller the pieces which enter the stomach the more easily will they be dissolved. It is unnecessary to go further into this, but it must be remembered that though portions of solid matter will escape from the stomach with the fluids, the less easily digested and larger pieces will remain in the stomach longer, and it may be five or six hours before they are expelled into the intestine. This naturally leads to a consideration of the act of vomiting by which the contents of the stomach are rejected.

Vomiting may be caused in many ways, by irritation of the stomach and other parts of the digestive tract by indigestible and unsuitable food or poisons, by obstruction of the bowels, by nervous influences, and by many other causes. It is generally preceded by a free flow of saliva,

which is swallowed with air and helps to open the orifice from the gullet into the stomach ; then a deep breath is taken and the glottis closed, thus preventing any vomited matter entering the air passages ; then strong contractions of the abdominal muscles occur, causing pressure on the stomach, which also contracts. As the result of these processes the stomach contents are forced upwards. Sometimes a backward wave of peristaltic action occurs in the small intestine, and if the opening of the stomach into the duodenum is open, bile may be vomited.

Constipation or deficient action of the bowels is shown by infrequent motions and the passage of hard masses of fæces (scybala). It is largely caused by feeble peristaltic contractions of the large intestines so that the fæces pass very slowly along this part of the bowel, and thus a long time is given for the absorption of fluid with the resulting formation of hard scybalous masses. With this excessive absorption of fluid there are absorbed also some excretory products, to which many of the general symptoms of constipation are ascribed. A secondary effect is that the bowel tends to become dilated with thinning of its walls and so more pronounced muscular weakness is caused. The careful preparation of food with absence of husks, seeds, and vegetable fibres contributes by leaving less residue to stimulate the bowel, but the chief cause of constipation is the loss of muscular power in the bowel wall associated with a sedentary indoor life and the want of regular habit in obtaining an action of the bowels. The bowel muscle responds to regular exercise just like any other muscle of the body and deteriorates from want of it. Hence the natural treatment of constipation involves a mixed diet in which whole-meal bread, fruits, especially those with seeds, and green vegetables take a large part, a free ingestion of fluid so that the contents of the bowel do not become dry and hard, massage to the abdomen following the course of the large intestine, healthy open-air exercise, and the cultivation of regular habits of evacuation.

Diarrhœa is the converse of constipation, and is caused by the rapid passage of the contents of the stomach through the intestines, so that there is no time for the motions to become solid and "formed" into their usual shape. It is generally caused by the presence in the bowel of some irritant which gives rise to excessive secretion of intestinal fluids and mucus from irritation of the glands throughout the digestive tract and to excessive muscular effort on the part of the intestine to get rid of its contents. Hence diarrhœa is generally accompanied with a discharge of mucus or slime and "colic," or painful griping contractions of the muscular wall of the small intestine. Also, when diarrhœa is extreme, as in acute dysentery or cholera, the amount of fluid abstracted from the body is so great as to cause hollowness of the cheeks and eyes, looseness of the skin, and sinking away of the body generally, together with extreme thirst. Perhaps the best example of this is seen in the extraordinary rapidity with which a plump baby will waste as the result of acute diarrhœa and vomiting. A few days will reduce a fat infant to little more than a skeleton. A purge generally acts by stimulating and exciting the activity of the intestines. Some, such as croton oil, act by producing irritation and its consequences, while the milder aperients act in various ways. Salts, such as magnesium sulphate (Epsom salts) and sodium sulphate, act by drawing fluid into the bowel and so producing a watery motion without much griping ; castor oil, by stimulating and exciting the small intestine ; aloes in a similar way affects the large intestine, and so on. Those aperients which principally act on the small intestine cause more griping and act more quickly than those which chiefly stimulate the large intestine, and hence in the former it is customary to add some sedative, such as belladonna, to diminish the colic which they would otherwise produce. Aloes and such aperients as do not begin to act till they have left the small bowel are more often prescribed for habitual use than occasional use and also take much longer to act, and hence are generally given early in the evening to produce an action next morning. It is not uncommon to prescribe two kinds of aperient—*e.g.* blue pill or calomel followed by salts—in this way combining two effects.

An enema or a suppository acts by stimulating the large intestine, and is therefore chiefly of use in emptying this great reservoir rather than in promoting a general activity of the whole intestinal tract. When something stronger than a simple soap-and-water enema is required, glycerine or turpentine may be added, as these drugs have a specially stimulating effect on the large intestine.

The Functions of the Liver.—The functions of the liver are best considered with the digestive tract because its chief function is to alter and modify the food products absorbed from the intestinal tract. The blood from the stomach and intestines passes directly to the liver on its way to the heart. It is collected into a large vein, the portal vein, which breaks up in the liver into capillaries, and is collected again into the hepatic vein, which joins the inferior vena cava to reach the right auricle (Fig. 7). The most important modifications which the blood undergoes in the liver are the conversion of certain of its waste products into urea (which is ultimately excreted by the kidneys), the alteration and storing of sugary and starchy matters so that they can be distributed to the tissues as required, and the formation of bile.

The Excretion of Waste Products.—Roughly speaking, the waste products of the body are : urea (with small quantities of uric acid and allied substances), carbonic acid, salts, and water. They are got rid of by (1) the kidneys, (2) the lungs, (3) the skin, and (4) to a very slight degree by the bowel. It will be understood from what has been said on digestion that the fæces are mainly the unabsorbed parts of the food—those portions which have never been taken into the body—and hence cannot be said to be waste products ; the fæces are the ash or unburnable part of the fuel. But there is a certain small quantity of excreted waste matter in the fæces—the bile produced by the liver and the secretions of the glands of the intestines. But the waste products excreted from the body juices into the digestive tract are so trifling that they may be neglected.

The production of carbonic acid and its excretion by the lungs is considered under respiration and heat regulation and requires no further mention here.

The urea and allied bodies, nearly all the salts and much of the water leave the body by the kidneys, so it is these we must chiefly consider in relation to excretion.

The blood is carried to the kidneys by the renal arteries, which rise from the abdominal aorta, and is distributed through these organs in minute capillaries, some of which end in little tufts or bunches (glomeruli) whilst others are distributed among the secreting tubules. The glomeruli are chiefly filters for the water, while the secreting cells lining the tubules pick out the urea and salts and other waste products and excrete them into the urinary ducts. The blood from the kidney is returned by the renal vein direct into the inferior vena cava. The amount of urine excreted by the kidneys in twenty-four hours is on an average 2½ pints, but this varies considerably under different conditions, of which the most important is the blood pressure. When it is realized that the blood comes to the kidney directly from the aorta—where the blood pressure is at its highest—and that the renal vein opens into the inferior vena cava—where the blood pressure is at its lowest—it will be understood that there is a very great difference in the pressure of the blood entering and leaving the kidney, and that the greater the difference the greater will be the amount of blood forced through the filtering apparatus and the greater the amount of fluid filtered. Hence in cold weather, when the fine vessels in the skin are contracted and the blood pressure high, more urine is passed; whilst in hot weather, when the vessels in

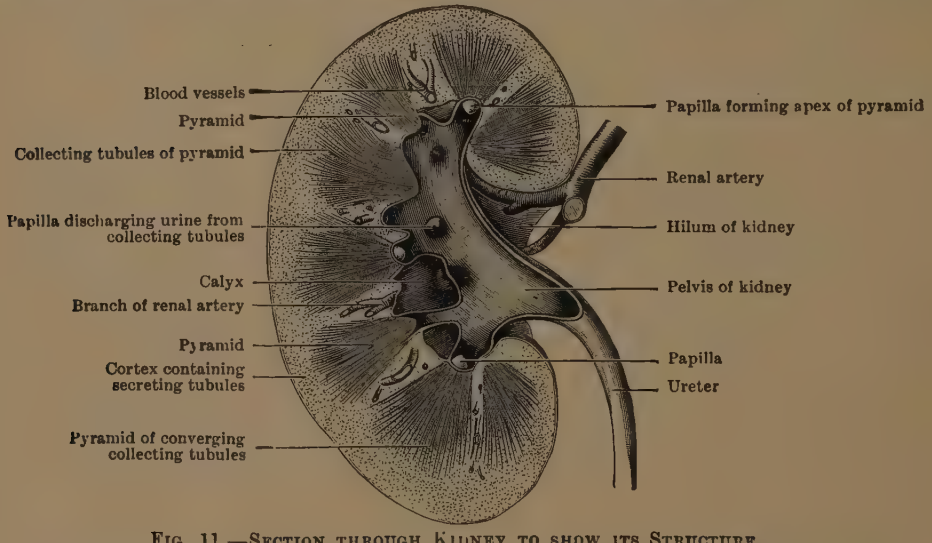


FIG. 11.—SECTION THROUGH KIDNEY TO SHOW ITS STRUCTURE.

The dotted area is the secreting portion containing the glomeruli and secreting tubules; the fine lines show the collecting tubules which pass the urine into the dilated portion of the ureter known as the pelvis of the kidney through the nipple-like papilla. The ureter is shown leaving the kidney to pass down to the bladder.

the skin are flushed and there is free perspiration, the pressure is lower and less urine is passed. Similarly when as the result of shock there is marked relaxation of the internal vessels and great lowering of blood pressure, little urine is secreted. Emotion or excitement also may cause constriction of the blood vessels and a rise of blood pressure, and is often followed by the passage of large quantities of pale urine. Again, loss of blood from hæmorrhage will lower the blood pressure and cause marked diminution in the amount of urine. In diseases associated with a high blood pressure a large amount of urine is passed, and in those with a low blood pressure a smaller quantity is passed. But blood pressure is not the only factor regulating the amount of urine passed; the composition of the blood and the state of the kidneys are also important.

The great function of the kidney is to excrete the various waste substances in solution in the blood, and the water is merely a convenient vehicle for carrying them away. These substances are chiefly—(1) Urea and allied bodies representing the waste of the protein or nitrogenous part of the food (p. 13); (2) salts not required in the body which have been absorbed from the food, the chlorides, phosphates, sulphates of soda, lime, etc.; (3) a certain amount of pigment derived from the bile and called urobilin—which gives colour to the urine.

Great differences may be noticed in the urine passed at different times and in health and disease. When a large quantity of urine is passed it is pale and watery; when a small quantity is passed it is highly coloured and on cooling often deposits a sediment or becomes thick. This is because a profuse flow of urine means that there is a dilute solution of the salts and colouring matter, whereas with a scanty flow it follows that there is a greater concentration of the salts and colouring matter. Hence as the concentrated urine cools some of the less soluble salts will crystallize and form a deposit; this is especially the case with the salts of uric acid, which are less soluble in cold water and form a brick-dust sediment. The doctor estimates the amount of

solids in the urine by taking its specific gravity, *i.e.* by floating a glass instrument (urinometer) in the urine and noting the depth to which it sinks. Such an instrument floats in pure water at the 1·000 mark, in dilute urine it will sink to the 1·005 to 1·010 mark, in average urine it will be about 1·020, and in concentrated urine 1·030 to 1·040.

The amount of urine is increased by drinking large quantities of water, by certain drugs, by cold, emotion, and other causes, in certain diseases like diabetes and chronic kidney disease (owing to the high blood pressure), and during the disappearance of dropsy. It is diminished by restricting the amount of fluid drunk, by heat, by profuse sweating or diarrhœa, in fevers, in shock, or after bleeding, and in heart disease (from stagnation of the circulation) and acute kidney disease (from damage to the kidneys).

In diseased conditions certain abnormal constituents appear in the urine. Albumin from the blood occurs in kidney disease and is found by boiling the urine, when it coagulates like the white of egg. A test tube is filled three-quarters full and the top of the urine boiled in a spirit lamp. The urine is made slightly acid with a drop of acetic acid or vinegar, as some salts (phosphates) occasionally form a cloudiness if the urine is not made acid. If there is very little albumin, a slight cloudiness only is noticed in the upper boiled part; if there is a considerable quantity, little white flakes of coagulated albumin form. In cases where there is a great deal, and the whole urine in the tube is boiled, it may form a solid mass like boiled white of egg, so that the tube may even be turned upside down without anything escaping. This is occasionally seen in eclampsia (p. 224) and the urine is described as being "solid with albumin." In diabetes sugar is present, so that although the patient passes a large quantity of very watery urine it has a high specific gravity. Nursing mothers generally have a certain amount of milk sugar in the urine, but it has no serious significance. Mucus from the bladder may be present, and in disease blood and pus from the kidney or bladder.

The urine is produced continuously by the kidneys and passes down by the ureters into the bladder, where it collects until the bladder is emptied by the act of micturition.

The Nervous System.—This consists of the central nervous system, the brain and spinal cord, and the peripheral nervous system, the numerous strands of nerve bundles that run from the central nervous system to all the organs and structures of the body.

In the central nervous system are the centres for the appreciation of the impressions received from outside and inside the body through the special senses and sensory nerves, and for originating the activities of the body through the motor nerves. There are centres which govern respiration, cardiac action, vasomotor action, and such actions as swallowing, vomiting, micturition, defæcation, and so on.

The physiology of the nervous system is extremely complex, and only the most essential features which it is important the student should know need be mentioned.

The upper part of the brain occupying the vertex of the skull—the hemispheres or cerebrum—is the thinking part of the brain and the part which governs all the voluntary movements of the body and appreciates the sensations conveyed to it by the sensory nerves. The right hemisphere governs the movements of the left side of the body and the left those of the right side. For instance, from the area which governs the movement of the right arm—which lies on that portion of the brain under the left parietal bone—a tract of nerve fibres runs down into the deeper part of the brain, where it crosses to the right side and then passes down the medulla and in the spinal cord till it reaches the level of the lower part of the neck, where the bundles of nerves emerge from the right side of the spinal canal to run down the arm of that side and actuate the movements of its muscles. Hence if the hemisphere on the left side is damaged in the region of the arm area or the tract before it crosses, the right arm will be paralysed, and if the damage is on the right side, the left arm will be affected; if the damage to the arm tract is below the crossing place, the arm on the same side will be paralysed. In an apoplectic stroke, which is caused by the bursting of a blood vessel in the brain with consequent destruction of the surrounding brain tissue, the hæmorrhage very commonly occurs above the crossing, because the blood vessels there are very poorly supported and therefore the opposite side of the body is paralysed (hemiplegia). A similar effect is produced if the blood supply to this part of the brain is cut off by clotting of the blood in the vessels (thrombosis) or by the vessels being blocked up by a loose clot being carried there (embolism). Roughly speaking, the surface of the brain contains these higher centres, whilst the base of the brain contains the tracts and bundles of fibres going to and from them. The tracts from below spread out fan-wise as they ascend to the surface of the hemispheres. But there are many complicated junctions and sub-stations in the lower part of the brain. The cerebellum, lying just behind the ear, helps to maintain equilibrium in standing, walking, and running, and just above the level of the nape of the neck are the very important vital centres governing respiration and such like. They are so important that a few words must be said about them.

This part of the brain is the direct continuation of the spinal cord and from its shape is known as the bulb or medulla. In it are small groups of nerve cells—called "centres"—which control the vital processes. Take, for example, the respiratory centre. If it were destroyed or paralysed, respiration would cease. If it is stimulated, respiratory activity is increased; if it is depressed, respiratory movements are diminished. It contains cells which excite inspiration and expiration, and they in turn are excited by impressions from the lungs, skin, and body generally. Stimuli from the skin—such, for instance, as a cold douche—excite inspiratory movements, and this stimulus is used in the newborn child when asphyxiated. If the blood contains excess of carbonic acid it also stimulates the respiratory centre, and in the fœtus the cutting off of the placental circulation and the consequent accumulation of carbonic acid in the

blood cause the first efforts of respiration which, if they occur before the birth of the head, may result in the sucking of fluids into the chest. Certain poisons affect it, such, for instance, as chloroform, so that when a patient has an overdose of chloroform the respiratory centre is paralysed and artificial respiration has to be carried out till it recovers again. Other important centres, like the cardiac centre, may be affected in a like manner.

In the spinal cord there are also centres governing other functions of the body, and this is important, because when the cord is broken, in a broken back for instance, these functions can still go on although the power of controlling them by will is removed by cutting off the communication from the brain. There is a centre in the lower part of the spinal cord governing the uterine power in labour, and cases have occurred in which labour has taken place normally after this part of the cord has been cut off from the brain by disease or injury to the cord higher up so that the lower part of the body is paralysed and has lost all sensation. Defæcation also will occur under similar circumstances, though the patient will not know and will have no control over it. Micturition, on the other hand, is generally interfered with. These centres in the brain and spinal cord are the factors which determine *reflex* action.

In a *reflex action* a message goes to the centre along the sensory nerves, and at once another message is reflected or sent down the motor nerve to effect some movement. An example of such reflex action has been already mentioned in the inspiratory movements resulting from the shock of a cold douche, but others might be instanced, as the closing of the eyelid when something is felt touching the eye, and the narrowing of the pupil which occurs when a bright light is held before the eye. In the latter instance, the effect of the bright light on the seeing parts of the eye is to send a message to the centre governing the pupil, and at once a message comes back along the nerves to the pupillary muscle, causing it to contract. A vomiting reflex is started by tickling the back of the throat, a coughing reflex by irritation of the windpipe or bronchial tubes, and so on. It will be noticed that very many of these reflex movements are protective. This last, for instance, means that if some irritating matter is drawn into the windpipe, a coughing reflex is set up to expel the cause of the irritation. It is important that the pupil midwife should understand these reflexes, because they are present in the newborn child, and in the case of the asphyxia of the newly born, the seriousness of the case depends on whether the asphyxia has been sufficient to paralyse reflex activity. In the less serious cases in which the reflexes are still present the child can be excited to breathe and cry by dashing cold water on its chest or smacking it, but if it is more deeply affected the reflexes are absent, and no amount of external stimulation will excite reflex response in the respiratory centre. Similarly, when a patient is being chloroformed the doctor touches the eyeball, and if the eyelid closes he recognizes that the patient is not fully under the anæsthetic ; or he may open the eye and see if the pupil narrows with the light. When the patient is so far chloroformed that it is possible to do an operation without her moving, the reflexes are abolished ; that is, the nervous system is so far paralysed as to stop the nerve centres being affected by messages coming to them through the nerves, but not so far as to paralyse completely the respiratory and other higher centres. This means that these centres are only cut off from nerve messages coming to them. If an overdose of chloroform is given and the centre completely paralysed, breathing would cease. An unconscious patient—such as a woman in eclamptic coma—has no reflexes and the eyeball may be touched without any winking movement resulting. In severe shock also the reflexes may be blunted or even abolished.

The Body Temperature and its Regulation.—Warm-blooded animals (mammals and birds) differ from the cold-blooded (frogs and other reptiles, fishes, etc.) in that their temperature does not vary—or only within very small limits—whatever the external temperature may be. The temperature of the human body is practically constant on the equator or in the arctic regions, in a Turkish bath or in an ice-house. In the frog, on the other hand, the temperature of its body varies with the outside temperature, and is higher in summer and lower in winter.

How is the temperature of the human body kept nearly constant at about 97° to 99° F. ?

The body may be compared to an engine in which the burning of fuel not only gives the power of doing work but also produces heat. Food is the fuel which enables us to do work and maintain the body temperature. The food is absorbed, distributed to the tissues all over the body, and there combines with oxygen, *i.e.* is oxygenated or burnt up as the coal in an engine is oxygenated during combustion. The fats and sugars (carbon and hydrogen—p. 13) give rise to carbonic acid (=carbon and oxygen or carbon-dioxide), which is excreted by the lungs, and water (=hydrogen and oxygen), excreted by the kidneys, lungs, and skin, while the protein substances (carbon, hydrogen, and nitrogen) give rise to urea (nitrogen and oxygen with a little carbon and hydrogen), as well as carbonic acid and water. These waste matters—carbonic acid, urea, and water vapour—are the equivalent of the smoke and waste gases produced by the combustion of coal. To complete the simile, the undigested and unabsorbable remains of our food, which passes through the bowel unused by the body to be evacuated as the fæces, represents the ashes and clinkers raked out of the furnace as the unburnable part of the coal. The chemical changes going on in the body are known in physiology as " metabolism " ; those chemical changes resulting in the building up of tissues from the food as " anabolism " ; those resulting in the breaking down of tissue material as " katabolism." Heat is chiefly produced by the breaking down or burning up of tissue material, *i.e.* by the katabolic processes of the body, the muscles, and to a less degree the glands, forming the principal site of this combustion. The more work the body does, *i.e.* in active muscular exertion, the greater the amount of fuel consumed, and therefore the greater the heat production. The more the body is at rest, *e.g.* during sleep or rest in bed, the less is the fuel consumption, and the less the heat production. This, then, is the means by which heat is produced, but it does not show how the body temperature is regulated

so as to be maintained at an almost constant level. This is done by the nervous system acting on the arteries of the surface of the body, mainly by means of those nerves described as "vaso-motor."

Let us consider how the temperature of the body is kept at its normal level when the outside temperature is low. In such a case the effect of the cold on the surface of the body is to bring about constriction of the small arteries in the skin, so that the surface of the body becomes pale and bloodless. The warm blood is thus kept in the interior of the body and the loss of heat reduced to a minimum. If, on the other hand, the external temperature is high, the arteries on the surface of the body dilate and the skin becomes flushed; at the same time the skin glands become active with the increased flow of blood, and a profuse sweating takes place. The evaporation of this layer of moisture on the skin causes marked cooling of the surface of the body, so the loss of heat is great. The blood in the dilated vessels over the whole skin surface loses heat and goes back cooled to the interior of the body and returns heated again to lose its heat in the skin. The reason why a dry heat is so much less trying than a moist heat is that the evaporation of sweat is much greater in dry air, and so the surface cooling is greater, whilst in a moist heat the evaporation is much less and the cooling of the surface proportionately less. In this way there is a very delicate mechanism which regulates the amount of heat lost, so as to keep the body temperature at the normal or thereabouts. Besides this there are other factors. In a cold climate the body requires to produce more heat as well as to prevent loss from the surface. Hence fatty foods—which are easily consumed to produce heat—are specially required. In a hot climate, on the other hand, less heat-producing food and more fluid and watery food, fruits and the like, are required, and it is more essential that the sweat glands be kept working well. Again, in active muscular exercise, when much material is consumed to produce energy, the heat production is greater, and therefore to keep the body temperature at its normal level the loss of heat must be increased. This is brought about just as when the external temperature is high. The skin flushes, the sweat glands become very active, and the surface of the body is cooled by evaporation, and with it the blood which rushes to the skin surface. This maintenance of the body temperature would occur quite independent of our own action in assisting it by clothing. But in order to make matters easier for nature and take the strain off our blood vessels we help nature by accommodating our clothing to external conditions. In cold weather we minimize the loss of heat from the surface of the body by extra heat-retaining clothing, the successive layers of air in and between the various garments acting as bad conductors of heat. The extra clothes are not heat-producing in themselves; they merely prevent our own heat being dissipated. In hot weather we make the cooling of the surface easier by wearing thin clothing, and allowing evaporation of the sweat on the skin surface. When, owing to extremes of heat and cold, the mechanism for regulating temperature is overtaxed and breaks down, death frequently results. In extreme heat, heat-stroke results, and is very liable to occur when severe exertion has to be done in great heat, especially in moist climates, in which the rapidity of evaporation from the surface of the skin and, therefore, also of its cooling is diminished; more heat is produced than the body can get rid of by increased loss from the surface; the body temperature rises, often to a very high degree (hyperpyrexia), and unless it is brought down at once by cold packing or ice compresses death quickly results. In extreme cold, and especially if accompanied by want of heat-producing food and want of heat-retaining clothing, there is not sufficient heat produced in the body to make up for the great loss from the surface, the temperature falls below normal and the sufferer becomes numbed and semi-conscious, gradually passes into stupor and coma, and, unless restored by warmth and stimulation, soon perishes.

It is extremely important that the pupil should have some idea of this mechanism for the heat regulation of the body, otherwise a proper understanding of the treatment of conditions in which this mechanism is disturbed, as in fevers, shock, and collapse, is impossible. If the temperature of the body is raised above its normal limits the condition is known as fever or pyrexia. This may be brought about in many ways, but is most commonly seen as the result of the poisons produced in the specific fevers and other illnesses. When a patient's temperature begins to rise above 100°, and to reach 102°, or 103°, the patient first experiences a sensation of cold—often complained of up the back—with shivering, and in cases where the rise of temperature is rapid a rigor may occur. When the temperature has reached its height the patient feels burning hot with a dry skin. If the temperature falls quickly it is often accompanied by very profuse sweating, the skin becoming moist and cool. When the temperature of the body is high, much more fuel must be consumed in the body to produce the additional heat and to make up for the increased loss. That is why prolonged fever causes such marked wasting. But not only does high fever burn up too much of the body tissues; it also, if it persists, damages the body tissues, and hence in cases of high fever it is often important to bring down the temperature. This may be done by rapidly increasing the loss of heat, either by drugs or the application of cold. Such drugs as quinine and the salicylates act by producing flushing of the skin and sweating. The direct application of cold by means of sponging, cold packs, or cold baths, acts by rapid cooling of the body surface. These, however, are but temporary measures, and in all cases of fever the poison causing the disturbance of the heat-regulating mechanism must be got rid of to bring the temperature permanently back to its normal limits. Other causes of fever are over-exertion, as is sometimes seen in cases of prolonged labour; excitement will also disturb the nervous mechanism of heat regulation, as in the emotional rises of temperature occasionally seen in the puerperium, a time at which the nervous system is easily affected. The marked characteristic of the emotional rise is that it is sudden in its onset and as sudden in its disappearance. The opposite condition to fever, a body temperature below the normal, is seen in shock

and collapse and in conditions when the vitality of the body is at a low ebb. A temperature slightly subnormal is of no moment, but in cases of severe shock or loss of blood, when it may fall to 96° or lower, it is a serious sign, showing that the patient's condition is one of great danger.

The temperature of the body undergoes well-marked daily variations. During sleep, when the vital processes are at their lowest, the temperature will drop to 97° or so, and then with the ordinary daily activity rise again to its highest in the early evening—when it will be about 98°·4 or even higher—and then drop again to its minimum in the early morning.

Internal Secretion.—A number of glands (such as the thyroid, pituitary, and adrenal) secrete directly into the blood instead of by a duct, and have a very important influence on metabolism and other bodily functions. They are known as *ductless glands*, but the term is not a good one, as some, like the pancreas, the testicle, the intestinal glands, and possibly the liver, have a duct, and produce both an external secretion discharged through it and an internal one into the blood stream. Another name is *endocrine glands* (meaning inward secretion) in contradistinction to the ordinary or exocrine glands with an outward secretion escaping by a duct. The substances that they effuse into the blood stream are known as *hormones*.

Because it has been most thoroughly worked out, the best one to consider first is the *thyroid*, the gland with a part lying on each side of the windpipe just below the larynx, that may become enlarged and form a goitre. Its secretion has a marked effect in hastening growth and increasing metabolism. It, so to speak, increases the draught or turns up the wick, and so causes the body to consume more material and burn it faster. Deficient thyroid secretion gives rise to the disease known as myxœdema in which the patient becomes heavy and sluggish, mentally and physically, with a lowered pulse-rate, heat- and carbonic acid-production (low basal metabolism), whilst excess of thyroid (with enlargement of the gland) causes exophthalmic goitre, in which the patient is thin, restless, and excitable with a quick pulse, nervous trembling, protruding eyeballs, and a raised carbonic acid production (high basal metabolism). Its effect in exciting rapid growth is well shown by feeding young tadpoles on thyroid fragments, when they pass rapidly through this stage and become frogs long before the usual time. In children, deficiency of thyroid results in cretinism. The cretin is a dwarf with arrested mental and sexual development. There is much interaction between the secretions of the various endocrine glands, among which are the sex-glands, the ovary and testicle, and over- or under-action of any of these glands may affect others and their functions. Thus thyroid deficiency in the adult may cause first excessive menstrual loss and then stoppage of the periods, whilst thyroid overaction tends to produce irregular and lessened menstruation. Also the thyroid gland may show slight enlargement at puberty and during menstruation and pregnancy.

Another important endocrine gland is the *pituitary*, a small body lying in the base of the skull below the frontal lobes of the brain. It has a larger anterior portion joined to a smaller posterior portion, the functions of the two being different. The anterior lobe influences growth and development, and its deficient activity results in small stature of the short-limbed thin type and lack of sexual development, whilst overaction produces gigantism of the long-limbed type and premature sexual development, often followed by exhaustion and deficiency (see p. 51). In adults, overaction of the anterior pituitary gives rise to the disease known as acromegaly, characterized by overgrowth of the bones of the skull and jaws, hands, and feet, and by excessive, followed after a time by decreased, sexuality. In women, cessation of the menstrual flow occurs, and with it a tendency to the development of masculine characteristics, such as growth of hair on the face and deep voice. The posterior lobe produces a secretion that excites contraction in involuntary muscle—of the uterus, intestines, arteries, etc.—and thus causes a rise of blood pressure.

The *Adrenal glands* that sit like a cap on the top of the kidneys have also a double secretion, one from the central portion (medullary) and another from the outer rind (cortical). The former has somewhat similar effects to the posterior pituitary, producing contraction of arterioles, quickened heart-beat, and consequent rise of blood pressure. Underaction gives rise to that fatal condition, Addison's disease, with wasting, feebleness, low blood pressure, and pigmentation of the skin. The effects of cortical secretion of the adrenal are mentioned on p. 51.

These instances are sufficient to indicate the important place occupied by the endocrine glands and their interdependence on one another; also how they work in with the sex organs. The internal secretions of the ovary itself will be described elsewhere (p. 51), and it must be understood that their effects will be modified by the secretions of the glands described here.

Before leaving this subject, it may be well to call attention to the valuable medicines obtained by making extracts of these glands obtained from animals. The best known in midwifery practice is pituitrin, the extract of the posterior lobe of the pituitary, which is often injected to excite uterine contraction in cases of hæmorrhage or weak expulsive power in labour, and in general medicine to treat shock or to stimulate peristalsis when bowel action is weakened. Another one is adrenalin, prepared from the medulla of the adrenal gland, which in strengths of 1 in 1000 is used also in shock and to raise blood pressure, and for other purposes. One drop in the eye immediately blanches the mucous membrane, and it is often used as a local application to check oozing by its power of contracting the small arteries and arterioles. Thyroid extract is also used in the treatment of many conditions in which it appears deficient. It and some others can be given by the mouth, as it is absorbed unaltered in the gastro-intestinal tract; others can only be given by injection into skin, muscle, or vein as their activity is destroyed by the digestive juices. Insulin, the preparation used in the treatment of diabetes, is prepared from the islets of cells in the pancreas, and is able to make it possible for the body to use the excess

of sugar circulating in the blood. In many cases the patient can be maintained in normal health by administration of these animal preparations, for example, a myxœdematous patient or a cretin by thyroid extract, but is never cured, for if the thyroid secretion obtained from an animal to act as a substitute for her own is not given, the disease at once returns.

C. BACTERIAL INFECTION.

Bacteria, sometimes loosely called "germs" and "microbes," play so important a part in the causation of child-bed fevers that the pupil midwife must have some little knowledge of their nature. Every examiner at the Central Midwives Board has had experience of the extraordinary ignorance exhibited by candidates as to what bacteria are and what they are like. A candidate will say that bacteria are "just germs"; whether animal, vegetable, or mineral she is uncertain, but generally imagines them as animals and of the nature of insects; all she knows is that the troublesome ritual of antiseptics is necessary to prevent them appearing from somewhere or other. If the midwife is to carry out intelligently the methods of preventing bacterial infection she must know more than this, and this brief account of the characteristics and mode of growth of the more important varieties of bacteria is given as the minimum of knowledge necessary for the well-trained midwife.

Bacteria are the lowest known forms of living organisms; they are fungi and belong to the vegetable world, coming lower in the scale than the moulds or mildews. Indeed, it is difficult to draw the line between the most highly organized bacteria and the most lowly organized of the moulds. If the pupil thinks of bacteria as of the same type of life as the moulds and as growing under somewhat similar conditions, she will have made a step in obtaining a conception of their nature. The moulds, as seen by the naked eye, grow in fine fluffy masses; the threads, examined under the microscope, are found to be composed of elongated cells, end to end, and branching in different directions. A single bacterium corresponds to a single cell in these fine threads of the mass of the mould, and a colony of bacteria growing on gelatine may look like a little white spot of mould. The microscope would show this spot to be made up of millions of little cells; it would take about twenty-five thousand of them placed end to end to make a line an inch in length, and each of them would be an individual bacterium. Some of the higher bacteria grow in branching forms with the cells joined together, as in the threads of the moulds (Fig. 12, *w*), but in most of the bacteria each cell is a separate individual. The method of reproduction in the moulds is a little more complex than in the bacteria where the simplest form of reproduction, that by division, is the rule. Under suitable conditions the bacterium divides into two; when these two reach full size they again divide into two, and so on. So rapid is the rate of multiplication that a bacterium may reach maturity and divide in about twenty minutes to half an hour, so that in twenty-four hours one will produce many millions. The white scum which forms on soured broth, in stale urine, and the muddiness in stale beer are due to masses of bacteria.

Just as in other plants, there are numerous varieties of bacteria which differ in shape and habit. The lower and more common forms are classified, according to their shape, into three main groups: (1) The cocci, in which the shape is globular; (2) bacilli, in which the bacteria are rod-shaped though the different bacilli vary greatly in length and sickness; (3) spirilla, which are of a curved or cork-screw, spiral shape. The rarer and higher forms, which form thread-like filaments by many individuals growing together, will not require further mention, as it becomes difficult to differentiate them from the lower types of the moulds. Some bacilli and spirilla have the power of moving through the fluids in which they live by means of a fine filament into which the end of the cell is drawn out. When the food material is exhausted or dries up many forms pass into a resting stage in which they form "spores" or seeds, which will grow into the original bacillary or spiral form when placed in suitable conditions as regards food and moisture.

These lower forms of bacteria, then, are minute single cells, each of which is a separate individual capable of reproducing the species with extraordinary rapidity by simple division. Though a colony of them containing many millions may be visible to the naked eye, to see the individual high magnification under the microscope is necessary, as some are even less than $\frac{1}{25000}$ of an inch in diameter. They are widely distributed, and are found especially in dust or dirt, and wherever there is decaying animal or vegetable matter. The skin, the mouth, and the intestines have all an extensive bacterial flora. The air of rooms and towns is full of them, so that, with a little exaggeration, they may be said to be universally distributed.

The great function performed by bacteria in the scheme of life is that of breaking up into simpler constituents dead vegetable and animal matter. By their action complex vegetable and animal substances are converted into simpler substances, which in turn can be used again by vegetables and animals to build up their own complex tissues. Fresh animal manure is not of any use to plants, for they cannot make use of it. When it has been rotted by the action of bacteria and moulds it is of the greatest value as a plant food, because then it has been broken up into simpler bodies which the roots can absorb. Bacteria are therefore essential to the life of the higher animal and vegetable world, and without them the higher life would come to an end. Their food material is for the most part of a complex nature, but some form of bacterial growth is possible in any organic matter. The bacteriologist uses many things for the culture of micro-organisms—broth, gelatine, or other jellies, blood, potatoes, bread paste, and so on.

During their growth bacteria produce substances which are detrimental to themselves, so that if they are grown in a closed vessel, such as a test tube, the growth will come to an end in time just as animals in a closed space would die from exhaustion of the air. It is the substances

which they produce, "toxins," which poison the body in the case of the disease-producing bacteria; also the poisonous effects of putrid food are due to the products of bacterial action.

Putrefaction and *fermentation* are instances of bacterial action, and a consideration of the conditions under which they occur is the simplest way of studying bacterial action, as it affords many lessons which can be easily followed. For the occurrence of putrefactive or fermentative change the presence of moisture is necessary. Flour when quite dry will keep indefinitely—but let it become damp and it will soon go sour and ferment. A piece of bread toasted dry will keep indefinitely—bread paste will soon become sour and mouldy. Even meat can be kept if it is dried; in some southern countries it is cut into strips, dried in the sun and preserved. Some degree of warmth is also required, but in regard to this each species has its own preference as to temperature; but there is a temperature below which no bacteria will grow, and one above which none will grow. The ordinary temperature of the body is generally the most favourable for bacterial action, but some growth may take place as low as 50° and as high as 150°, but only to a very slight extent and in exceptional cases, and indeed many organisms are killed before a temperature of 150° is reached. There is this difference, however, between the effect of heat and cold: cold even below freezing-point does not destroy the organisms—warmth would again start their growth; heat, on the other hand, completely destroys them. Few will survive a temperature of 150° if long enough applied, and boiling, as is well known, for even a few minutes will kill all but the spores of a few very resistant bacteria. Certain facts in domestic economy illustrate these points. It is during the hot summer weather that food is most difficult to keep, and hot thundery weather is the time when milk is most likely to become sour. The larder is always put in the coolest place, and to keep meat and fish in hot weather an ice-chest is necessary. Strong sunlight prevents the growth of bacteria, and kills them if the exposure is long enough. Even diffuse daylight is unfavourable to their growth. Some bacteria cannot grow in the presence of air, *i.e.* of oxygen; others cannot grow without oxygen. Much air is unfavourable to micro-organisms in that it causes drying. It may thus be said that the conditions which favour the

FIG. 12.—DIFFERENT FORMS OF BACTERIA.
(From Muir and Ritchie.)

a–h. Types of cocci.
a. Simple cocci.
b. Lancet shape (*pneumococcus*).
c. Biscuit shape (*gonococcus*).
d. *Streptococci.*
e. *Staphylococci.*
f. Tetrads.
g. Sarcina.
h. Capsulated cocci.
*i*¹–*i*⁷. Bacilli.
k–n. Spirochætes.
n. *Spirochæta pallida*, the cause of syphilis (p. 327).
o. Mixed spirilla type.
p. Spirilla.
q. Forms with fine filaments (flagellæ) which give them power to move in fluids.
r. Flagellæ.
*s*¹–*s*⁴. Types of spore formation.
*s*⁵. Detached spore.
t, u, v. Degenerate forms, owing to growth under unfavourable conditions.
w. Streptothrix.
x. Leptothrix.
y. Thiothrix.

The various forms of bacteria illustrated here are magnified about a thousand times. The lower forms are shown first, and more highly organized forms below. The form *w* is very like a mould, and is much more complex than the simple cocci and bacilli shown above.

growth of moulds are also the conditions which favour the growth of bacteria. Damp and warmth in sunless and airless quarters are productive of free bacterial growth.

It will be instructive to consider one or two instances of putrefactive processes as examples of bacterial action, and to consider the methods employed in everyday life to prevent putrefactive change. Take the "souring" of milk, or lactic acid fermentation. In this the milk sugar is converted by the growth of bacteria into lactic acid—which gives the sourness to the milk—and the lactic acid in turn curdles the milk; when much acid is produced it interferes with bacterial action, and the process may be checked by the very change the organisms themselves produce. Bacteria generally grow best in a slightly alkaline medium, and yet this production of acid substances, which will ultimately check their growth, is common. Paste, broth, and beer go sour with putrefaction, and the rancidity of butter is another instance. Sometimes alkaline substances are produced, as by the small coccus which grows in urine and converts the urea into ammonia. The ammoniacal smell in stables and of stale urine is due to this change. Every housewife knows that the smallest drop of "turned milk" will cause a large quantity of fresh milk to become sour very quickly. Milk-cans must be thoroughly scoured to remove every particle of old milk and scalded to kill all organisms, otherwise any milk put in them would soon be sour. This shows that a very small number of organisms is sufficient to infect a large amount of material—hence the necessity for scrupulous cleanliness in the dairy and wherever food material is kept. The first consideration, then, in the preservation of food stuffs is extreme care in the cleanliness of all vessels and utensils, and next the use of an ice-chest in keeping the food below the temperature at which bacteria can grow. The carrying of meat from Australia and New Zealand in the freezing chambers of ships depends on the checking of bacterial action. A better instance for our purpose, because it is similar to the methods of surgery and obstetrics, is the preservation of food material in bottles and tins. This is done by sterilizing the food by heat, bottling or tinning it in receptacles also sterilized by heat, and then sealing it up so that organisms cannot obtain access to it. Prepared in this way, milk, soups, jellies, and fruits may be preserved indefinitely. Occasionally, when the methods have been faulty and the bacteria have not been entirely excluded, some degree of putrefaction or fermentation may occur and poisoning may result from the food being eaten. This is especially liable to occur with tinned meats, and is termed ptomaine poisoning—ptomaines being the poisonous products of bacterial action. This method of preservation will be seen to correspond to the "aseptic" system, but chemical preservatives, boracic acid chiefly but occasionally formalin, are used to make milk, butter, sausages, and other foods keep longer, and may be said to correspond to the "antiseptic" system. The use of chemical preservatives is not free from danger and is strictly limited by law. Other instances of chemical preservation in food material are pickling in brine and vinegar and the smoking of hams and fish. These methods correspond to the use of disinfectants, but are naturally of limited application, for non-poisonous and innocuous chemicals which will stop putrefaction are few in number and not efficient.

Having now considered the conditions under which bacteria grow, let us turn to the differences between the putrefactive and the disease-producing bacteria. Bacteria are usually divided into those which grow on dead matter, the putrefactive bacteria or *saprophytes*, and those which live on living tissues, the *pathogenic* or disease-producing. This distinction is not, however, one which can be maintained at all strictly. Many saprophytic bacteria, given suitable conditions, may be able to exist in the living tissues, and nearly all the pathogenic bacteria can be grown outside the living tissues on dead matter if special care be taken to provide them with just the conditions they like. All the disease-producing organisms grown in tubes in the bacteriologist's laboratory are for the time being saprophytes. Again, many organisms exist on and in the body as saprophytes which may under other circumstances attack the body and become pathogenic. But though the distinction between saprophytic and pathogenic bacteria is only a rough one, it is useful and worth retaining. Again, the saprophytic bacteria may be a cause of disease even though they are acting as saprophytes. This will be seen frequently to be the case in puerperal sapræmia (p. 241). Another instance is the infection of the urine in the bladder with the micrococcus already mentioned as the cause of the ammoniacal change in urine. If through the use of a dirty catheter the tiniest speck of stale urine is introduced into the bladder, this ammoniacal fermentation is started in the urine in the bladder and gives rise to irritation and inflammation. The urine in such cases is foul-smelling, and passed frequently owing to the irritable condition of the bladder. Here the organisms are not living on the living tissues but on the urine, and yet disease is produced. A bacillus found in the large intestine, the bacillus coli, is a harmless saprophyte there, but it may give rise to serious disease as a saprophyte in the urine or in the puerperal uterus or may become pathogenic and give rise to peritonitis should it get from within the intestine to the peritoneal cavity. But so long as it is kept in mind that there is no hard-and-fast line between the saprophytic and pathogenic bacteria, the distinction on a wide basis is useful and helpful.

The pathogenic bacteria include the *tubercle bacillus*, which gives rise to the many manifestations of tuberculosis, consumption in the lungs and of the bowels, hip disease, spinal disease, tuberculous glands of the neck, and such-like; the *typhoid bacillus*, causing typhoid fever; the bacilli of diphtheria, tetanus, anthrax, and so on; the spirilla of relapsing fever; the pneumococcus causing pneumonia, the gonococcus causing gonorrhœa, and the other pyogenic, or pus-producing, cocci. These are but a few of the more important, and as it is impossible to describe all of them, those which specially concern midwifery practice, the pyogenic cocci, alone will be considered, as they give rise to the most serious forms of puerperal fever.

The cocci commonly found in the septic infections of child-bed are the *streptococcus*, the

staphylococcus, and the *gonococcus*. The pneumococcus is sometimes found in the infected uterus, but is not of sufficient importance to deserve special mention. The gonococcus also merits consideration as the cause of the ophthalmia of the newly born. Cocci are the common flora of abscesses, though other bacteria, such as the colon bacillus, the tubercle bacillus, and the glanders bacillus, may be found alone in suppuration.

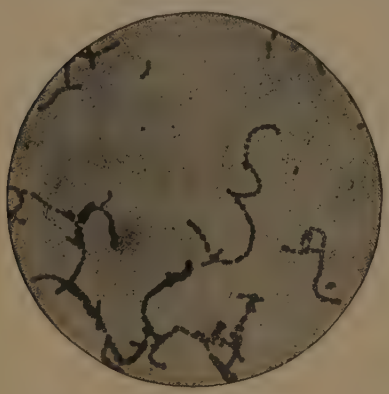


FIG. 13.

Streptococcus pyogenes culture on agar, showing chains of cocci. × 1000.

The *streptococcus pyogenes* grows in long chains so that the round cocci seen under the microscope look like strings of beads (Fig. 13). It is found in erysipelas, abscesses in joints and bones, in septic peritonitis, septicæmia, and pyæmia. Though it varies greatly in its virulence, it is perhaps the most virulent of all the pyogenic organisms, and when found in the blood gives rise to a most serious form of septicæmia.

The *staphylococcus pyogenes* differs from the streptococcus in growing in little clumps or masses instead of in chains (Fig. 14). It is found in localized abscesses, and boils and pustules in the skin, in internal abscesses, and in similar septicæmic and pyæmic conditions to those mentioned under the streptococcic infections. It also varies greatly in virulence, but is generally somewhat less virulent than the streptococcus.

The *gonococcus*, again, is quite different in its microscopical appearance from the cocci described above; it grows in pairs, so that it is usually described as a diplococcus or double coccus, and is commonly found within the cells of the part affected (Fig. 15). It is found in the pus from vaginal discharges or from the eye in the ophthalmia of infants. In the female it infects the glands of the cervical or uterine mucous membranes, and may spread along the Fallopian tubes to the peritoneal cavity and cause abscesses in the pelvic peritoneum. It does not give rise to a generalized infection through the blood like the streptococci and staphylococci, but spreads locally along the mucous membranes. When once it has deeply infected the glands of the cervix it is very intractable and may persist a very long time in a semiquiescent state.

Taking these pyogenic cocci, then, as illustrative examples of the pathogenic bacteria, the next point is to see how they attack the living tissues of the body, how the body receives their attack, and what effects are produced on the body. This means a consideration of two points, the strength of the attack and the resistance of the living tissues.

With regard to the first point, the strength of the attack depends mainly on two factors, the virulence of the micro-organism itself and the number introduced into the body—in other words, the strength and the dose.

The virulence of the bacteria, at any rate of streptococci and staphylococci, depends more on the disease condition from which they have been obtained than on the actual organism; so that the same organism varies greatly in virulence. Thus the streptococcus pyogenes from a rapidly fatal septic peritonitis or a severe erysipelas will probably be extremely virulent, while the same streptococcus from a chronic abscess may be very weak. The use of antiseptic solutions may weaken the power for harm of the micro-organism without destroying it. The bacteriologist can raise the virulence of an organism by growing it under favourable conditions and weaken it by growing it under unfavourable conditions, and the same thing occurs naturally in the body. Generally speaking, cocci from a severe and acute suppuration are much more virulent than those from a chronic suppuration where they have become exhausted by the struggle for existence with other organisms and weakened by the accumulated products of their own growth. Also a few bacteria may not be able to carry on the struggle for existence among the living tissues of the body when a large number would survive readily. But besides these two factors—the virulence of the organism and the number introduced into the body—there is another factor to consider, and that is the resistance of the living tissues.

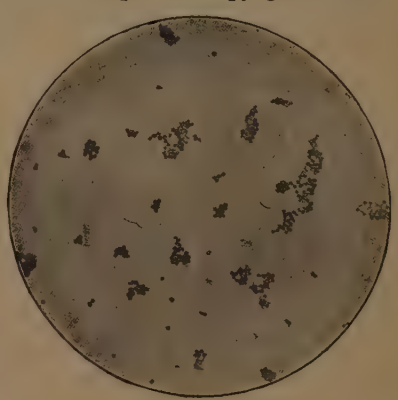


FIG. 14.

Staphylococcus pyogenes aureus, young culture on agar, showing clumps of cocci. × 1000.

This resistance may be general or local. The general resistance of the body depends on the fact that the living cells and fluids maintain a struggle against invasion by micro-organisms, the white cells (leucocytes) of the blood playing a very important part. When, say through a poisoned wound of the finger, bacteria obtain entrance to the tissues, the leucocytes and living tissues do all they can to resist the invasion, and if the bacteria are few in number and not of great virulence, they will be destroyed and eaten up by these cells. If the struggle is more

severe, the circulation to the part will be increased—as shown by redness, swelling, pain, and heat (the usual signs of inflammation) in the region of the wound ; that is, there will be a local inflammation by which the body will endeavour to confine the trouble to the affected area of the finger and raise a barrier against its spread from there into the rest of the body. The barrier is really the marshalling of numbers of leucocytes to destroy the bacteria. The action of these cells of the blood and the cells of the tissues in eating up and destroying bacteria has been called " phagocytosis," and these cells have been called " phagocytes " or " devouring " cells because they surround the bacteria, kill and digest them. But many of these cells acting as phagocytes are themselves destroyed, and these dead cells form with the fluids the " pus " or matter of an abscess. To go back to our instance of a poisoned wound of the finger, if the bacteria obtain a foothold there an abscess will form in the finger ; first there will be redness, swelling, pain, and heat, caused by the increase in the local blood circulation, the red edge representing the barrier to keep back the invading organisms. As a result of the fight many of the phagocytes will be killed and there will be formed a collection of pus, *i.e.* an abscess, the pus being made up of the fluids of the tissues and the dead leucocytes and tissue cells. Suppose, however, the bacteria are more virulent or in greater numbers than the local resistance can cope with, they may break through the barrier and spread into the arm, giving rise to a poisoned arm, or the struggle may be transferred to the lymphatic glands in the armpit where the cells of these glands and the blood cells will form another barrier to keep the bacteria from getting farther into the body. Here again an abscess may form. But if the organisms are extremely virulent or the resistance of the tissues very feeble, there may be little or no effective local reaction either in the finger, in the arm, or in the nearest lymphatic glands, and the bacteria may spread and multiply over the whole body, through the blood stream, so that blood taken from any part of the body will contain the invading organisms. This latter condition is that very serious form of blood-poisoning called septicæmia. These examples enable us to understand what is meant by general and local resistance. The general resistance of the body depends on the activity of the circulation and the power of the fluids and cells of the body to overcome invasion by micro-organisms. It is usually greatest in healthy persons, and is least in those debilitated by disease, bad living, drinking habits, great loss of blood, and so on. It is what is popularly termed a " good constitution," and " good healing flesh." The heavy drinker will fall an easy prey to bacterial infections where a temperate person would quickly overcome the same infection because of the greater resistance of his tissues to invasion. The resistance is increased by good health, good hygiene, and temperate living, but it may also be increased to individual organisms by some degree of what is called " immunity." For instance, by inoculating a small dose of bacteria or of bacteria of little virulence and then repeating it in gradually increasing strength, the resistance of the body to that organism may be gradually increased so that it becomes accustomed to deal with the invasion until a large dose, which would have been fatal had the body not been prepared by this heightened resistance, can be injected without effect. The same thing occurs in the case of drugs like arsenic and morphia. A patient accustomed to take these drugs can take a much larger dose than one unaccustomed to them, so that many patients who habitually take morphia or arsenic require, in order to obtain any effect, a dose which would be fatal to one unused to them.

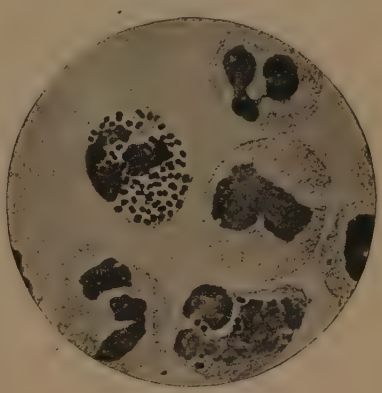


Fig. 15.

Portion of film of gonorrhœal pus, showing the characteristic arrangement of the *gonococci* within leucocytes. × 1000.

The local resistance means that the tissues in different parts of the body vary in their power of resisting invasion. Owing to local disease or injury, the resistance at one place may be less than elsewhere. If the circulation in the leg or foot is sluggish owing to varicose veins, thrombosis, infantile paralysis, etc., local infection will occur more readily there than elsewhere. Bruised and damaged tissues are easily infected, hence the ease with which abscess and suppuration occur in them. This is of importance in midwifery, because in a difficult labour with laceration and bruising of the soft parts, infection occurs more readily by reason of the lowered resistance of the damaged tissues.

The next point for consideration is the types of blood-poisoning which result from bacterial infection. A general septicæmia in which the organisms, usually some form of streptococcus or staphylococcus, obtain entrance to the blood stream and grow and multiply all over the body, has already been mentioned. Pyæmia is a special clinical variety of this, the word meaning " pus in the blood." It is characterized by the occurrence of suppuration in different parts of the body, in the joints, pleural cavity, lungs, liver, and other internal organs, and arises usually as the result of the infection of the veins with micro-organisms. Infected thrombi or blood clots are formed and carried to other parts, where abscesses form. Thus infection of the uterine and pelvic veins may result in affected thrombi being carried to the right side of the heart and from there to the lungs, where multiple abscesses will occur ; infection by the intestinal veins (or of the umbilical vein in the newly born) will result in abscess in the liver ; or the infection may show itself in distant joints and cavities of the body. The other form of blood-poisoning

is called "sapræmia," and is due to the absorption into the circulation, not of the organisms themselves, but of the poisonous products of their growth, putrefactive and otherwise.

Mention has already been made of the poisonous effects of food in which ptomaines and other products of bacterial action are present. Similar bodies, generally termed "toxins," are produced by bacterial growth; and though the bacteria may remain localized and never obtain entrance to the circulation or be distributed over the body, the soluble substances they produce may be absorbed into the circulation, causing a toxæmia. In septicæmia it is these toxins produced all over the body which poison the blood; in sapræmia it is the toxins produced in one spot which poison the body. For instance, as the result of infection of the cavity of the uterus during the lying-in time we may have various forms of blood-poisoning. The uterine cavity is an ideal breeding-ground for bacteria. There is always food material for their growth (blood clot, epithelial débris, and discharge from the raw surface left after separation of the placenta and membranes). Moisture, the warmth of the body temperature, and the absence of light are the very conditions mentioned as favouring their growth. At the same time, in the uterine cavity itself they escape the struggle for existence they would have to face among the living cells of the body. The substances in the uterine cavity are dead—blood clot is "dead" blood, the cell débris and bits of membrane are dead matter cast off from the uterine walls and devoid of the properties of the living tissues to resist bacterial action. Hence, if they obtain entrance to the uterus, bacteria will multiply rapidly and produce the poisonous ptomaines and toxins which will be absorbed by the blood vessels and lymphatics of the uterus into the general circulation and carried all over the body, though the bacteria themselves may be confined within the uterine walls and not spread into the living tissues of the body. Not only will pathogenic organisms grow in the uterine cavity, but the ordinary saprophytic organisms will have an opportunity of flourishing in the absence of living cells.

Hence there are two types of puerperal fever: (1) in which the organisms, pathogenic or saprophytic, grow in the dead material in the uterine cavity and poison the patient by the toxins they produce; (2) in which the organisms having obtained entrance to the cavity pass into the living tissues, first into the vessels of the uterine wall and from there into the general circulation where they grow and multiply all over the body; in this form only the pathogenic organisms will invade the body. The first variety is puerperal sapræmia, and the second puerperal septicæmia. The two forms may occur together, and frequently do so; that is, there is a mixed saprophytic and pathogenic infection of the fluids in the uterine cavity and poisoning of the body by their products, and also a pathogenic infection of the blood stream and poisoning from it. Naturally a pure sapræmia is much more favourable than a mixed infection or a pure septicæmia, because removal of the putrid products and disinfection of the interior of the uterus, checking the manufacture of toxins, may bring the poisoning to an end. On the other hand, once the organisms are in the blood stream they are beyond the reach of chemical disinfectants, and all that can be done is to keep up the patient's strength and encourage the resistance of her tissues so that the cells and fluids of the body may win the victory and wear down and destroy the bacteria.

Before leaving this subject, some explanation must be given of the treatment of bacterial disease by artificially increasing the resistance of the body to a particular organism. One method is inoculation with bacteria whose virulence has been attenuated in some way, *e.g.* growing at abnormal temperature or in the presence of weak antiseptics or other unfavourable conditions, or of virulent bacteria in very small quantities insufficient to produce death or serious illness. Other methods are the injection of dead bacteria or solutions containing their toxins (poisonous products). These methods are an attempt to do what nature does in those diseases in which one attack protects against another, as scarlet fever, typhoid fever, smallpox, and so on. In these cases something is produced in the body which enables it to resist a second attack of the same disease, and this immunity in varying degrees lasts for months and years, and perhaps for a lifetime. Vaccination against smallpox is really a method of producing artificial immunity by this process. The virus of smallpox passed through the cow becomes extremely attenuated, and when inoculated into the human body produces a very slight illness—vaccinia—which gives a certain amount of immunity to the original disease, smallpox. This immunity lasts for several years, but ought to be strengthened by revaccination at intervals; the more the subsequent vaccination "takes" the more has the protection of the previous vaccination diminished: a completely protected patient ought not to be susceptible to vaccination. As a result of vaccination the patient is not likely to catch smallpox, and if he does it will be in so mild a form that smallpox in the vaccinated is a different disease from that in the unvaccinated. Naturally vaccination is not a complete protection, for even an attack of smallpox itself is not a complete protection, as occasionally the disease occurs twice in the same person; but it is so rare in the fully vaccinated that it may be said that the efficiently vaccinated are nearly as immune to smallpox as those who have had the disease itself. Other methods of producing immunity, as already mentioned, are by injection of dead bacteria or of the toxins produced by the bacteria. All these act in the same way, by inducing in the body an increased resistance or some degree of immunity by the formation of some substances which act as antidotes to the bacteria or their poison.

These substances have not been isolated or definitely recognized, but are spoken of as "antibodies," and when they are present in the blood and tissues of an individual—whether as the result of the disease itself or of inoculation—greatly increase his power of withstanding invasion by the organisms of that disease. Vaccines are used in many diseases—including puerperal fever—to stimulate the production of antibodies and resistance to the disease. For example,

if a patient is being poisoned by streptococci, these streptococci are grown from the blood or uterine discharge and then killed and the dead organisms injected. This injection is called a " vaccine " and helps to cure the patient by causing an increased production of antibodies, *i.e.* increased resistance of the tissues to that particular organism. Similar vaccines prepared from the organism causing the patient's disease are used in other infective conditions—boils and abscesses, bacterium coli infections, etc. The antitoxic serum used in diphtheria and tetanus and the antistreptococcic serum used in septicæmia are attempts to introduce the antibodies from another animal into the human body by injecting its blood serum. The diphtheria antitoxin is obtained by injecting into a horse the toxin of diphtheria—not the bacteria. At first small doses are used, then gradually stronger and stronger doses until the horse can stand one dose which would be rapidly fatal to an unprotected animal. After several months an enormous dose of toxin can be injected into a vein without affecting the animal, which is then considered as immune. The animal is then bled under aseptic precautions, the serum being separated from the blood and preserved for use in sealed vessels. The serum is found to contain the antitoxic bodies, and if mixed with the toxin and injected into animals is found to have neutralized all the poisonous properties of the toxin. Injected, say, into a guinea-pig, that animal will be able to resist a dose of toxin many hundred times greater than a fatal dose to an unprotected animal. That is, this antitoxic serum has the power of neutralizing the diphtheria poison in other animals, and if injected into diphtheria patients early in the disease will quickly bring it to an end and in a large number of cases effect a complete cure.

The antistreptococcic serum used in puerperal septicæmia is not an antitoxin, but acts by increasing the resistance of the body to the invading organisms and thus leading to their death. It is obtained, not by injecting the toxins as in diphtheria antitoxin, but by the injection of the living organisms into the horse. Very virulent streptococci are injected at first in small doses, and then in gradually increasing amounts until the animal develops so high a degree of resistance that a large dose of virulent streptococci can be injected into a vein without causing septicæmia. At this stage the horse has developed in his blood " antibodies " which have killed these virulent bacteria. Blood is then drawn off as before described, and the serum preserved aseptically. This serum contains substances antagonistic to the streptococcus, and when injected into a patient suffering from streptococcus septicæmia leads to the death of this micro-organism. An antistaphylococcic serum is also prepared for cases of septicæmia due to staphylococcus infection, but the difficulty in cases of puerperal fever is that often the exact organisms causing the disease are unknown or cannot be discovered till the disease is very advanced. Indeed in many cases more than one organism may be the cause.

The work of the bacteriologist in discovering how to increase the resistance of the blood and tissues to bacterial infection and produce immunity and how to destroy the poisonous effects of bacterial toxins has led to some of the greatest advances of modern medicine, and much more is to be hoped for in this direction.

PART I.—ANATOMY AND PHYSIOLOGY.

CHAPTER I.

THE BONY PELVIS.

The elementary knowledge of the anatomy of the bony pelvis, which is essential to a proper understanding of even the simplest facts of midwifery practice, can only be acquired in one way, and that is by studying the pelvis itself ; it is impossible to obtain any adequate conception of its structure from diagrams. Diagrams are of use in assisting the pupil to apply the text and to recognize the various anatomical

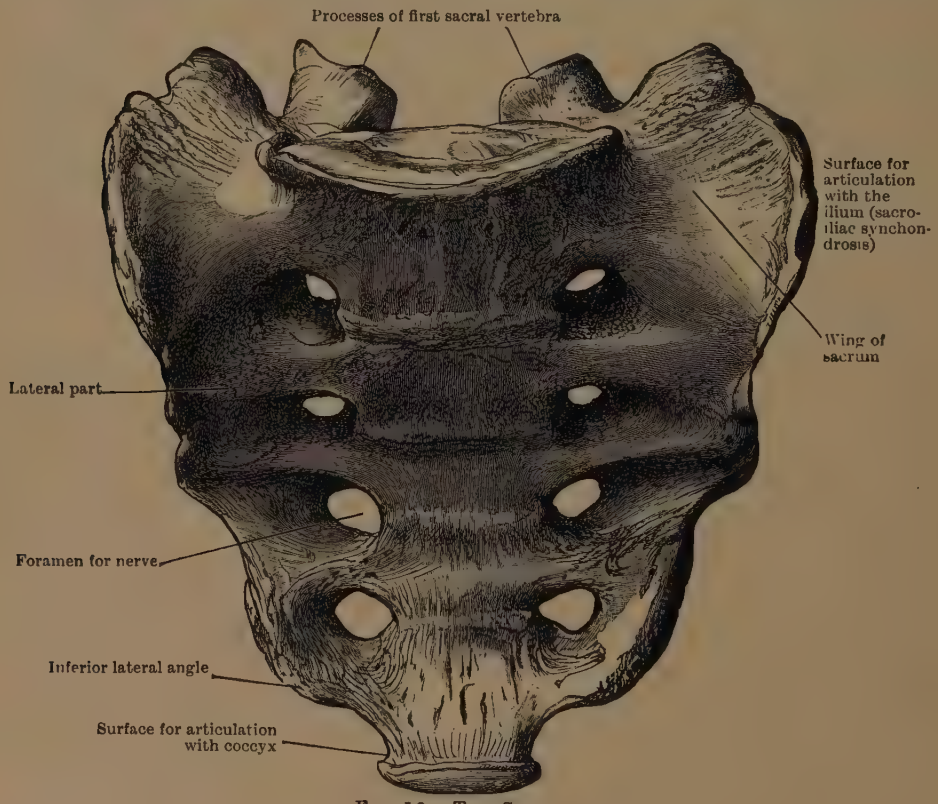

Processes of first sacral vertebra
Surface for articulation with the ilium (sacro-iliac synchondrosis)
Wing of sacrum
Lateral part
Foramen for nerve
Inferior lateral angle
Surface for articulation with coccyx

Fig. 16.—The Sacrum.

points, but they can never be a substitute for a study of the actual pelvis. All schools which undertake the training of midwives will possess, for purposes of instruction, one, or more than one, articulated female pelvis with the natural ligaments, and in the teaching of this chapter it will be taken for granted that the student has one of these pelves in front of her.

In the introductory section on the skeleton it was stated that the *pelvis* is the bony ring into which the back bone passes above, and which carries the weight of the body and transmits it to the lower limbs. From an obstetric point of view,

however, we have to consider it as the cavity which contains the generative organs, and as the canal through which the child has to pass during birth.

The *pelvis* is made up of four bones united together. They are the *sacrum* and *coccyx* behind, and the *two hip bones* (or *innominate bones*) at the sides and in front. It is best to consider each of these bones separately, and afterwards to study the pelvis as a whole.

The *sacrum* and *coccyx* form the lowest portions of the spinal column; the former consists of five vertebræ, the largest at the top and the smallest at the bottom, welded into one bone, while the coccyx consists of four very small vertebræ forming a tail-end to the spine. If the back of the sacrum is examined the five spinous processes of the vertebræ which go to form it can be identified. Looking into the pelvis, the front of the sacrum will be seen to present a hollow or concave surface, and to form with the coccyx the space in the pelvic cavity which is often referred to in obstetrics as the *hollow of the sacrum*. Four pairs of *foramina*, or openings for the nerves from the spinal cord, will also be seen on this surface. On each side of the sacrum is a cartilaginous joint, connecting it with the hip bones, known as the right and left *sacro-iliac synchondrosis*. Of special importance is the marked projection which is formed by the junction of the top of the sacrum with the last separate vertebra of the spinal column, the fifth lumbar vertebra. It is known as the *sacral promontory*. The last lumbar vertebra is usually left attached to the sacrum in the pelvis prepared for the use of midwifery classes so as to preserve the proper configuration of the sacral promontory, which is one of the most important landmarks in obstetric anatomy.

The *coccyx* calls for little attention. It can move slightly at its attachment to the sacrum (the sacro-coccygeal joint), and is pressed back during labour to give more room for the passage of the head.

The *hip bones* are rather more difficult to describe, for they are each made up of three bones which meet together at the hip-joint, and become firmly joined into one by the time the growth of body is completed, *i.e.* at about the age of 20 to 25, so that on examining them in the prepared pelvis no trace of the original divisions can be discovered. As the names of the three bones are used in describing what in the adult pelvis appears as only one bone, the multitude of terms may be somewhat confusing at first. The bones which join to form the hip bone are the *ilium*, the *ischium*, and the *pubes*. The part taken by each of them is roughly as follows. The *ilium* forms the upper and back part; the expanded saucer-like portions on each side of the pelvis are known as the "*wings* of the *ilia*," and their hollow inner surfaces as the *iliac fossæ*. The *ischium* is the lower part below the hip-joint; it forms the round projection on each side, called the *tuberosity of the ischium*, on which the body rests in the sitting posture. Just inside and behind the tuberosities are the ischial spines, from which arise some of the ligaments which pass over to the back part of the sacrum and help to close in the sides of the bony pelvis. The *pubes* is the front part of the hip bone; it runs from the hip-joint to the joint in front between the two hip bones, the *symphysis pubis*, and then turns down towards the ischial tuberosity, thus forming with its fellow of the opposite side the arch below the symphysis, the *pubic* or *subpubic arch*. On the upper surface of the pubes, on each side of the symphysis, is a small projection, the *spine of the pubes*. In each hip bone, between the hip-joint, the symphysis pubis, and the ischial tuberosity, is an oval space covered with a thin membrane. This space, which gives lightness to the pelvis, is the *obturator* or *thyroid foramen*, but often spoken of in midwifery books as the *foramen ovale*. It has no great importance from an obstetric point of view, but the name must be borne in mind, as it is sometimes referred to in describing the position of the presenting part in the pelvis.

In the prepared pelvis used for teaching purposes some of the natural ligaments are left attached to the bones. Reference has just been made to the thin membrane covering in the obturator foramen. Two strong ligaments, the *sacro-sciatic*, will be seen at the sides behind; the greater sacro-sciatic ligament runs from the tuberosity of the ischium to the back part of the ilium, sacrum, and coccyx, while the lesser one runs from the spine of the ischium to the sides of the sacrum and coccyx, its fibres partly mingling with those of the greater sacro-sciatic ligament.

Another ligament, the *inguinal* or *Poupart's ligament*, runs from the anterior superior spine of the iliac crest to the spine of the pubes, but scarcely concerns us in midwifery work ; roughly, it represents the line of the fold of the groin in the living subject.

Having studied its component bones, the pelvis must now be studied as a whole. It is divided into the *true* and the *false pelvis* by a very definite boundary. The dividing line may be traced on each side from the promontory of the sacrum forward to the symphysis pubis. It begins with the rounded upper border of the sacrum,

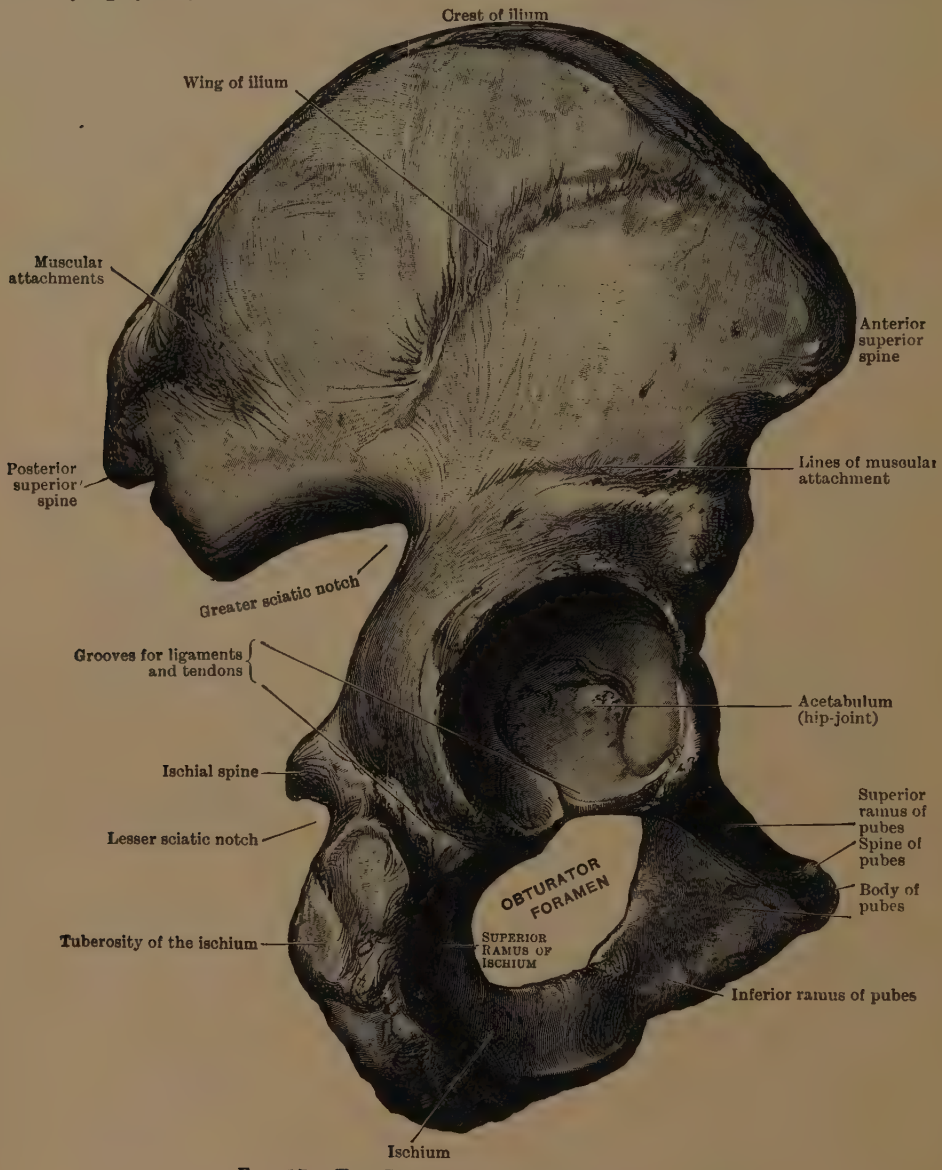


FIG. 17.—THE RIGHT HIP BONE (OUTER SURFACE).

then crosses the sacro-iliac synchondrosis, and continues forwards as the rounded border which forms the lower margin of the iliac fossa—known as the *ilio-pectineal line*—and along the upper surface of the pubes to the symphysis.

The part above this line is the false pelvis, and forms part of the abdominal cavity. In the living subject, when it is closed in by the abdominal walls, it contains intestines, except after the third month of pregnancy, when the uterus rises up out of the true pelvis into the abdomen. Hence it is very much less concerned with the problems of labour than the true pelvis. There are, however, a few points

connected with the false pelvis which ought to be noted. Observe the rounded upper margins of the iliac bones, called the *iliac crests*. They end behind in a prominence called the *posterior superior spine*, and in front in another and more important, the *anterior superior spine*. To the latter is attached the ligament

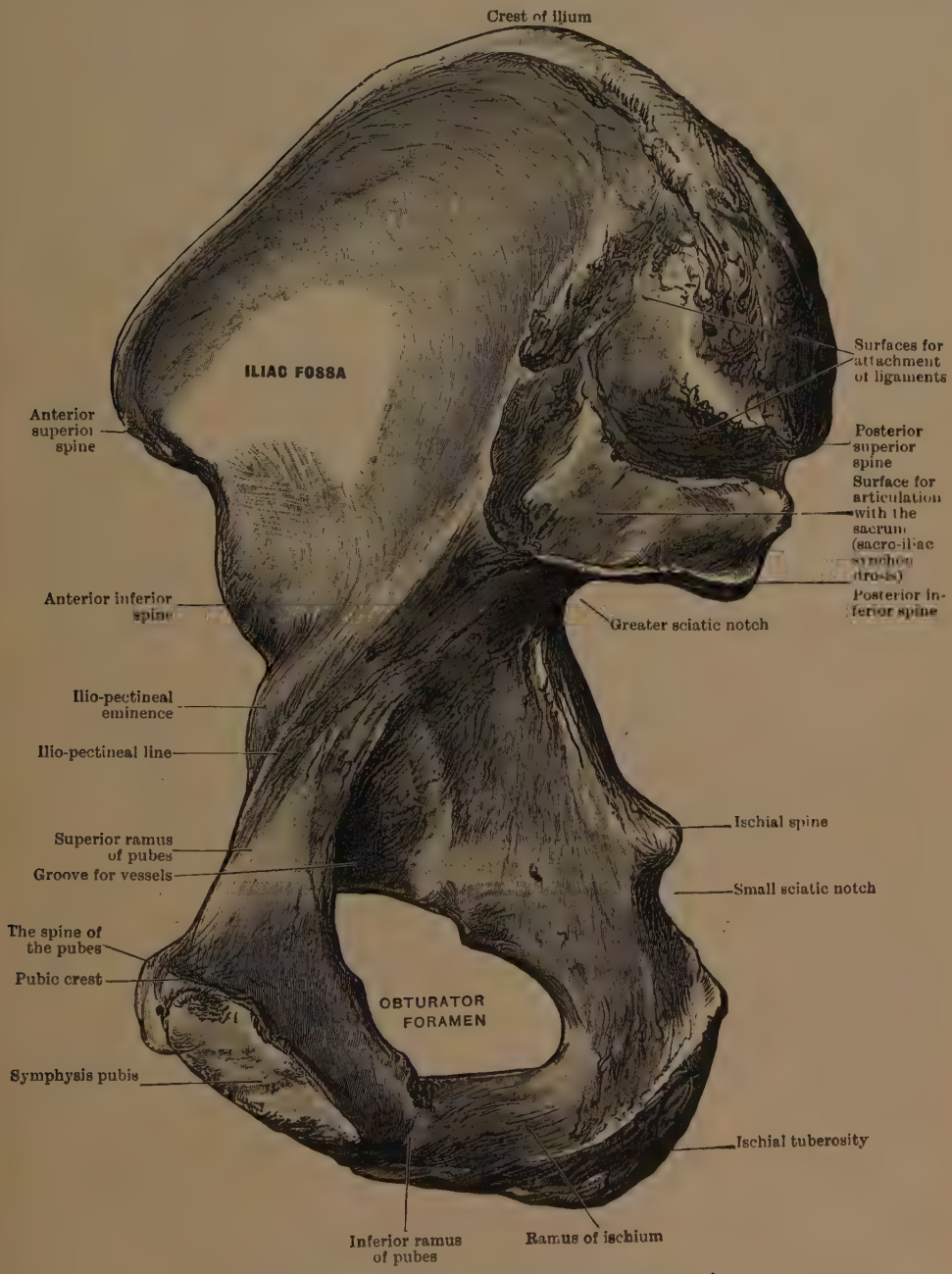


FIG. 18.—THE RIGHT HIP BONE (INNER SURFACE).

already mentioned as the inguinal ligament. When the measurements of the pelvis are discussed later on it will be found that the iliac crests and the anterior superior spines are used as points for measuring the pelvis, for they are only thinly covered by soft parts in the living subject, and so can be easily felt.

As the *true pelvis* forms the bony canal through which the child passes during parturition, it must be studied in considerable detail. It is to be looked on as a

hollow cylinder—though its walls are incomplete in places, and the simplest way will be to begin first with the inlet or entrance, then to take the outlet or exit, and to leave the canal itself to the last.

The *pelvic inlet* or *brim* (Fig. 19) is the space included within the line dividing the false from the true pelvis. It is roughly heart-shaped, the promontory of the sacrum forming a slight projection into it behind ; it is widest from side to side, and narrowest from back to front, *i.e.* from the sacral promontory to the symphysis. As the inlet is entirely surrounded by bone, the measurements of its diameters can be accurately estimated, and are very important, for any variation below the normal may indicate grave difficulty in labour. There are certain diameters which are used for estimating the size of the pelvis and describing the movements of the presenting part in labour, and these must be defined before going further.

The diameter of paramount importance in obstetrics is the *true conjugate* or back to front diameter. It is measured from the mid-point of the promontory to the nearest point on the back of the symphysis, and is roughly about 4 inches in length. In the majority of cases the length of the conjugate diameter is greater

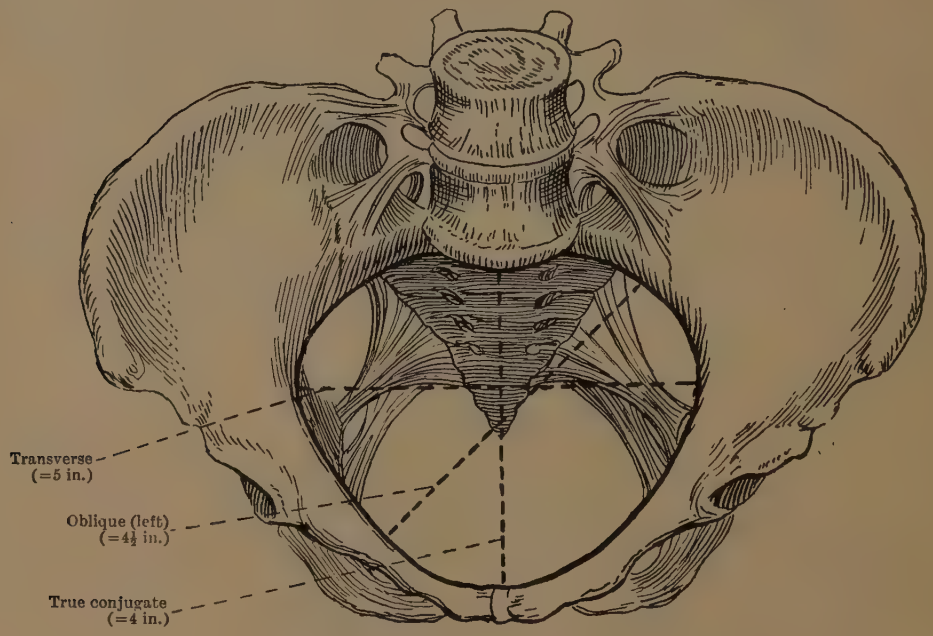


Fig. 19.—The Pelvic Inlet.

than this—probably nearer 4¼ inches, but it is usual to look on a " four-inch pelvis " as a normal one, and one measuring less than this as contracted.[1]

The *transverse* or side-to-side diameter extends across the greatest width of the brim (a little behind the mid line) and measures 5 inches.

In addition to these two diameters, which divide the brim into 4 quadrants, two oblique diameters are described, which subdivide it further into 8 sections. The *right oblique diameter* runs from the right sacro-iliac synchondrosis to the opposite point on the left side of the brim represented by a slight elevation on the ilio-pectineal line, known as the ilio-pectineal eminence. The *left oblique diameter* similarly runs from the left sacro-iliac synchondrosis to the right ilio-pectineal eminence. Each of these oblique diameters has a measurement midway between that of the conjugate and transverse, namely, 4½ inches.

The term " plane of the brim " or " plane of the inlet " is one which is frequently used to describe an imaginary surface occupying exactly the level of the brim. If the pelvis be placed in the position which it occupies in the body in the erect position,

[1] The round numbers here given are those usually adopted by obstetricians, though from a strictly anatomical point of view they are less than the average.

it will be noticed that this surface has a very steep slope, so that it looks almost directly forward. The best way to appreciate this is to place the pelvis so that the sawn surface of the thigh bones (which are commonly left attached to the prepared pelvis) rest on the table, thus bringing them into the position of the erect posture, and to lay a small sheet of paper carefully in the brim, keeping it exactly at that level. It will then be seen that the sacral promontory is about $3\frac{1}{2}$ inches higher than the symphysis, and that the surface of the paper slopes down towards the table at an angle of about 60 degrees. In other words, the plane of the inlet is inclined at an angle of 60 degrees to the horizon (Fig. 21).

If the pelvis is now turned upside down it will be seen that the *outlet* is diamond-shaped ; the top angle is at the under part of the symphysis, while the opposite one is at the tip of the coccyx. The junctions of the sacro-sciatic ligaments with the ischial tuberosities form the lateral angles. The sides of the diamond are formed in front by the bony margins of the pubic arch, and behind by the sacro-sciatic ligaments (Fig. 20). Also note that the top and bottom corners of the diamond

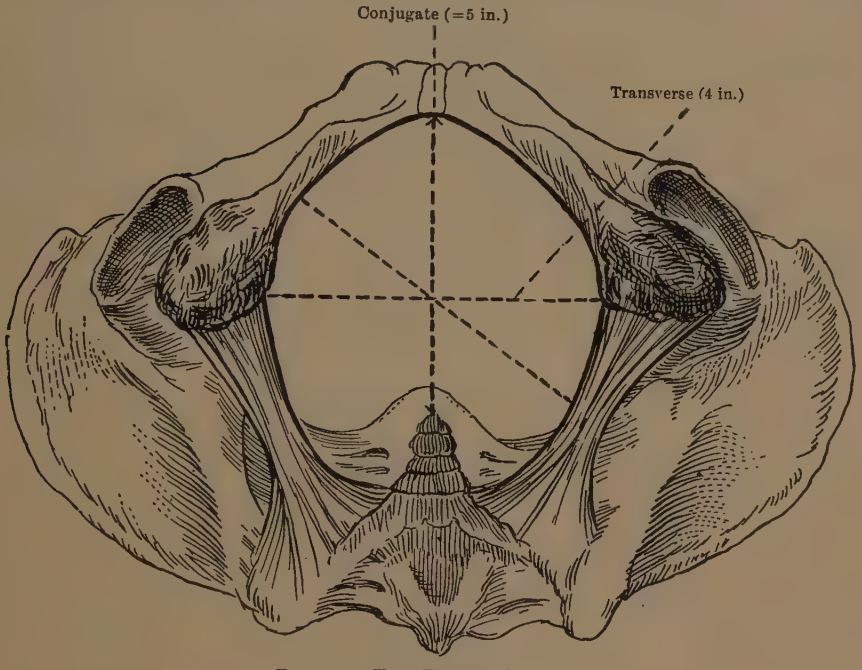


Fig. 20.—The Pelvic Outlet.

are bent back, so that the lateral corners—the ischial tuberosities—are lower than the others. Besides the difference in shape between the inlet and outlet of the pelvis, there is a further difference in the measurements of its diameters. The longest diameter at the inlet is the transverse ; at the outlet it is the shortest—it is the one between the ischial tuberosities, and measures barely 4 inches. On the other hand, the conjugate diameter, which was the smallest at the inlet, is the longest at the outlet, measuring from the symphysis to the coccyx 5 inches, and even more when the coccyx is pushed back to its utmost. The oblique diameters at the outlet cannot be accurately measured, as they lie between soft distensible structures and are therefore of very variable lengths.

From what has already been said of the different levels of the corners of this diamond-shaped opening, and because the coccyx moves slightly during labour, it will be evident that a " plane of the outlet " exactly corresponding to that of the inlet cannot be described. So when the plane of the outlet is described an imaginary surface is taken on a level with a line drawn from the tip of the coccyx to the lower border of the symphysis. It has not the steep slope of the plane of the inlet, being only slightly inclined at about an angle of 11 degrees with the horizon. Also this

plane does not accurately correspond to that of the outlet in the living subject, owing to the influence of the soft parts, as will be seen in a later chapter.

The *cavity of the pelvis* is that part of the canal between the inlet and the outlet. Looking into the pelvis, it will be seen to be formed by the symphysis pubis in front, by the concavity of the sacrum and coccyx behind, and at the sides by the ischium and the part of the ilium below the ilio-pectineal line, with the sacro-sciatic ligaments and other soft parts filling in the deficiencies in its bony wall. It is much deeper behind than in front—from the sacral promontory to the tip of the coccyx measures $4\frac{3}{4}$ inches, while from the upper to the lower border of the symphysis is

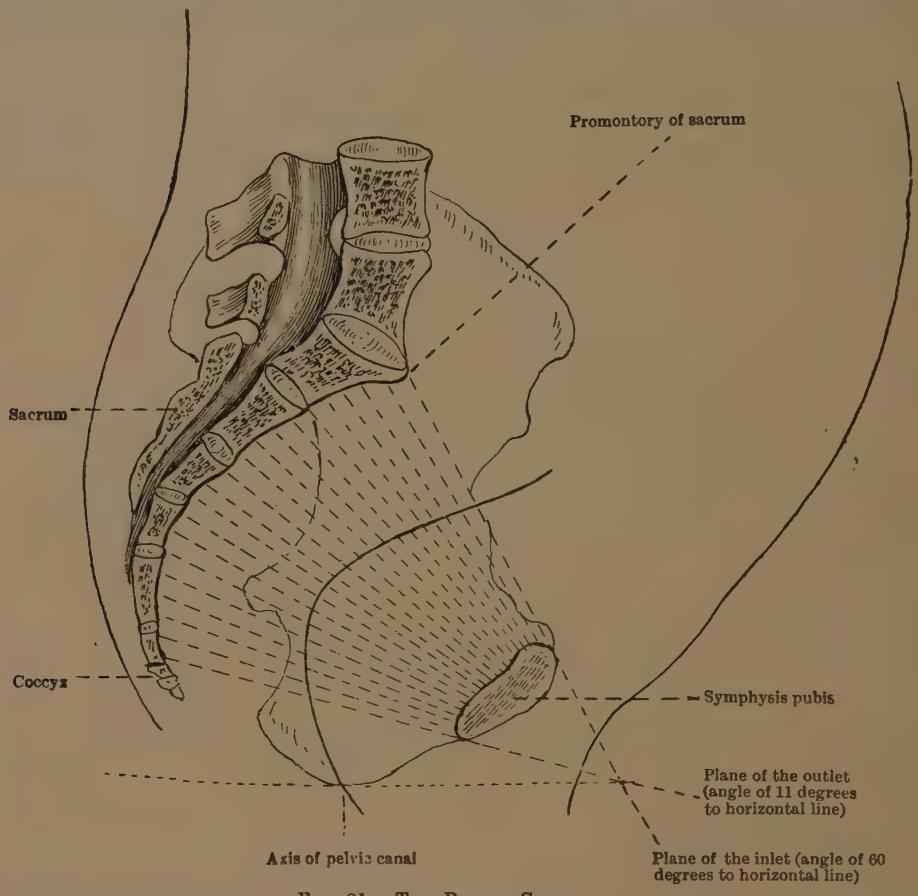

Promontory of sacrum
Sacrum
Coccyx
Symphysis pubis
Plane of the outlet (angle of 11 degrees to horizontal line)
Axis of pelvic canal
Plane of the inlet (angle of 60 degrees to horizontal line)

FIG. 21.—THE PELVIC CAVITY.

The pelvic axis is shown as a curved line corresponding to the curve of the sacral hollow. At the inlet it is nearly a line from the umbilicus to the coccyx; at the outlet the line is approximately from the anus to the sacral promontory. Note that the sacral promontory is higher than the top of the symphysis (by about $3\frac{1}{2}$ in.) and that the slope of the planes in the pelvis diminishes from the brim (over 60 degrees) to the outlet (11 degrees).

but $1\frac{1}{2}$ inch. The sacral hollow increases the back-to-front diameters, so that the cavity is no longer like the inlet, wider from side to side than from back to front, but is more nearly of the same width all round, and therefore is nearly circular in shape. The diameters of the pelvic cavity cannot be measured accurately like those of the bony inlet, as they vary at different levels in the cavity, and also the soft parts play an extensive part in the formation of its walls. In order to give an approximate idea of the size of the cavity, it may be stated that, roughly speaking, its diameters, conjugate, transverse, and oblique, are all about $4\frac{1}{2}$ inches. It is evident that any number of planes can be drawn at different levels in the pelvic cavity between those of the inlet and the outlet, and that the higher ones will slope more than the lower—in fact, that the inclination will diminish from that of the

inlet at 60 degrees to the horizon to that of the outlet at 11 degrees. Now, these planes are of importance, in that by studying them we find the direction which a body will take in passing through the pelvic canal. It will pass in a direction at right angles to all these surfaces, from the plane of the inlet to that of the outlet, and the line formed by joining up all these directions at right angles to the planes will give the *axis of the pelvic canal*, or the course which is taken by a body passing through it. Now this axis will be found by studying Figure 21 to be a curve with its concavity looking forward, and to be nearly the same as the curve formed by the hollow of the sacrum. A proper conception of this curve is so necessary, as it is not only the course which the child follows during its birth, but also the direction in which operations from below, like forceps delivery or manual removal of the placenta, must be conducted, that it will be worth while explaining it still further and in another way. Imagine for a moment a curved cylindrical tube, say a drain-pipe, of about the same dimensions as, and curved like, the axis of the pelvic canal (Fig. 22). Now cut down the surface of the inlet into this pipe to an angle of 60 degrees with the horizon, and the outlet to 11 degrees, and make the back wall $4\frac{3}{4}$ inches in length and the front wall $1\frac{1}{2}$ inch, and a curved canal is obtained exactly similar to that of the pelvis. This curved pipe will indicate clearly the kind of canal through which the child has to pass during parturition. Before leaving the question of the axis of the pelvic canal, it will be well to consider its axes in relation to the living subject. The axis of the inlet, *i.e.* a direction at right angles to the plane, is very nearly that of a line drawn from the umbilicus to the middle of the coccyx (Fig. 21), and this is the direction which the head takes when it enters the pelvis, and is the direction in which the pull has to be made when it is necessary to drag the head into the pelvis by means of forceps. Similarly, the curved axis of the cavity is the direction which the child takes through the cavity, along which the pull is made in forceps delivery, and the hand of the attendant must take in doing any operation from below; and so also with the axis of the outlet, which is approximately that of a line drawn from the sacral promontory to the anterior edge of the anus. This will serve to show how labour in the human subject is complicated by the curvature of the pelvic axis. Were it a straight canal, the child would be pushed straight through, instead of having to accommodate itself to the curve as well as to the variations in its width at the various levels. The complicated nature of the mechanism by which delivery is affected is largely due to these special features. It will be seen later, however, that the axis of the parturient canal is further influenced, especially at the outlet, by the muscular

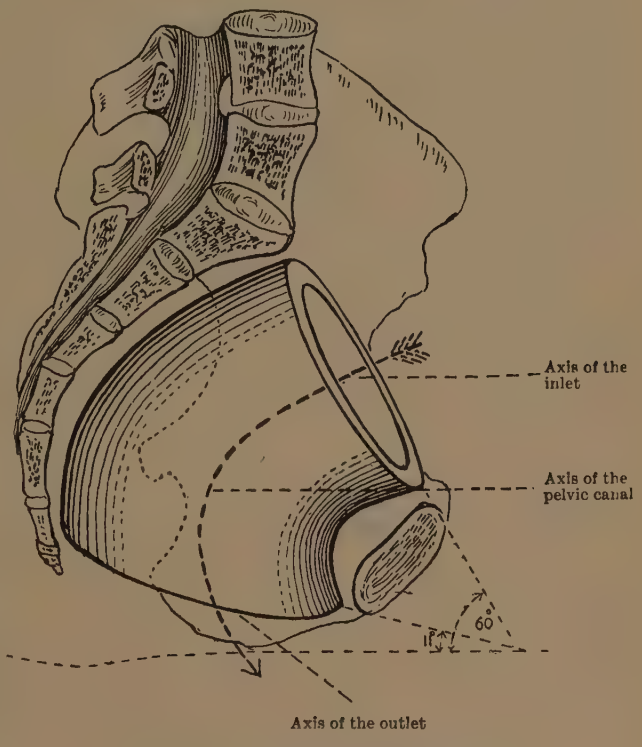


FIG. 22.—THE CURVED PELVIC CANAL.

A curved drain-pipe fitted into the pelvis to illustrate the characteristics of the pelvic canal. The surfaces of the inlet and outlet are cut away to correspond with the slope of the pelvic inlet and outlet. Note the difference in the length of the back and front walls of the pipe.

soft parts, but a full consideration of this will be left till the physiology of labour is described.

Before leaving the anatomy of the bony pelvis it is necessary to explain how the measurements which have been described are estimated in the living subject. This is done by (1) external and (2) internal measurements. The external measurements give only a very approximate idea of the size of the pelvis, and can only be made by special instruments for the purpose (pelvimeter). Still, these measurements are frequently carried out in lying-in hospitals, so they ought at any rate to be understood. Those most commonly made are (1) the distance between the widest parts of the iliac crests on each side, (2) the distance between the two anterior superior iliac spines, and (3) the external conjugate or distance between the part in front of the symphysis pubis and the depression below the spine of the fifth lumbar vertebra behind. These measurements are made by special callipers—(see Fig. 91, p. 202) called a pelvimeter—by placing one leg on the one point and the other on the other point and then reading off the measurement as shown on the dial. It will be noticed that the first two belong to the false pelvis. The first, commonly called the *intercristal* or bisiliac diameter, usually measures about 11 inches; and the second, called the *interspinous*, 10 inches. The conclusions which can be deduced from these measurements are twofold. Any marked diminution in their lengths would indicate that the whole pelvis was small, *i.e.* that known as a generally contracted pelvis (p. 199). Next, if there was an alteration in their relative proportions, *i.e.* if the interspinous diameter was nearly as long as the intercristal, and still more if it was longer, it would show that there was some rickety change in the pelvis, due to the anterior superior spines being splayed outwards while the bones were still soft. Thus a flattened pelvis (p. 199) would be suspected. The third diameter—the external conjugate—gives a rough idea of the internal conjugate at the brim. It usually measures about $7\frac{1}{2}$ inches, and by subtracting 3 to $3\frac{1}{2}$ inches, an approximation to the internal measurement is obtained. It is not, however, very reliable, as it depends on the amount of fat under the skin and other factors, and not much stress is laid on it, but if under 7 inches pelvic contraction may be suspected.

The method of internal measurement is of far greater importance, and, as it can be easily performed by the midwife, calls for a more detailed description. The diameter which is measured is known as the *diagonal conjugate*, and is the distance between the sacral promontory and the lower margin of the symphysis pubis. It is about $4\frac{3}{4}$ inches, and by subtracting $\frac{1}{2}$ to $\frac{2}{3}$ of an inch a fairly close approximation to the true internal conjugate at the brim may be obtained. In order to obtain the length of the diagonal conjugate in the living subject, two fingers, the index and middle fingers, are passed into the vagina and pressed up as far as possible until the middle finger rests on the sacral promontory. Care must be taken that the sacral promontory is the actual point touched; in deformed pelves a "false" promontory may be formed by an unusual projection of the first sacral vertebra over the second. The point on the back of the hand just under the symphysis is then marked by putting a finger of the other hand on the place, and the fingers withdrawn from the vagina (see Fig. 95, p. 203). By measuring with a tape the distance from the tip of the middle finger to the point marked as at the lower margin of the symphysis, the length of the diagonal conjugate is obtained, and the true conjugate estimated by subtracting rather over half an inch. Thus, suppose the distance from the tip of the middle finger to the mark on the edge of the hand under the symphysis is $4\frac{1}{2}$ inches, the true conjugate would be under 4 inches, *i.e.* the pelvis would be slightly contracted.

It is usual to summarize the internal pelvic measurements as follows:

	Antero-posterior or conjugate.	Oblique.	Transverse.
Brim	4	$4\frac{1}{2}$	5
Cavity	$(4\frac{1}{2})$	$(4\frac{1}{2})$	$(4\frac{1}{2})$
Outlet	5	$(4\frac{1}{2})$	4

CHAPTER II.

THE ANATOMY OF THE FEMALE GENERATIVE ORGANS.

The generative organs lie partly inside the pelvis and partly outside it. The former are known as the internal, and the latter as the external, generative organs. With the internal organs it is convenient to consider the other structures in the pelvis, bladder, rectum, etc.

It is more difficult for the pupil midwife to learn the anatomy of the soft parts than of the bony pelvis, as she has less opportunity of seeing dissected specimens showing the organs as they lie in the body. However, the knowledge required by the midwife to enable her to understand the scientific and theoretical portions of obstetrics is of quite an elementary character, for the most part simply a good general idea of the relative position of the organs and of the part they play in pregnancy, labour, and the puerperium. To acquire this in the best way she must take every opportunity of studying preserved specimens, such as may be seen in museums, and models of the organs, such as are used for teaching purposes in the training schools. Further, by continuing the method advised in the previous chapter, and reading this and the succeeding chapters with the articulated pelvis in front of her, and mentally filling in the soft parts round the bony with the help of the diagrams, she will greatly minimize her difficulties. Throughout the sections on anatomy it will be assumed that this is done, and an endeavour will be made to describe how the soft parts are fitted in round the pelvic bones.

The most difficult part to explain to students who have not had the advantage of examining the parts by dissection is the way in which the floor of the pelvis is formed—the bottom of the "basin," in fact, which holds up the organs and prevents them falling down through the pelvic outlet. For this reason the pelvic floor is best left to the last. The plan adopted here will be to describe first the internal organs, then the external organs, and the way they are connected together, and finally the supporting structures which bind them together and form a floor to the pelvis.

The Internal Organs.

Looking into the brim of the pelvis, the following structures would be seen from before backwards (Fig. 23). The *bladder*, lying in the middle line just behind the symphysis pubis; behind it the womb or *uterus* with the *uterine appendages*, *i.e.* the *Fallopian tubes*, the *ovaries*, and the *broad ligaments* on each side of it; at the back the *rectum*, or lowest part of the large bowel, coming down into the pelvis over the left sacro-iliac joint, and passing obliquely over the front of the sacrum towards the middle line. These organs are covered by a layer of *peritoneum*, the thin smooth and shining membrane which lines the whole of the abdominal cavity. Let us now consider each of these organs in detail.

The *bladder* is somewhat firmly attached below to the lower part of the uterus and to the anterior vaginal wall, while its upper part is free, so that it can easily expand as it fills with urine. Also it is attached to the back of the pubes by loose connective tissue, which allows it considerable freedom of movement. When empty or only moderately distended it remains entirely in the pelvis, but if it becomes greatly distended it rises into the abdomen, and may be felt through the abdominal wall. It is filled by the *ureters*, two small tubes which run down from the kidneys over the brim of the pelvis and open into its base, near its attachment to the neck of the uterus. It is emptied by the *urethra*, which runs down the anterior

vaginal wall to open externally. The uterus and its appendages form the internal organs of generation, and therefore require a more exhaustive description. The *uterus* is a hollow pear-shaped muscular body, measuring 3 inches in length, 2 in breadth, and 1 in thickness. It lies in the pelvis so that its long axis is in the axis of the inlet, its rounded upper end—the large end of the pear—looks forwards and upwards, whilst the lower pointed end looks downwards and backwards towards the lower part of the sacral hollow.

Now, for the time being, put the pelvis aside, and consider only the uterus

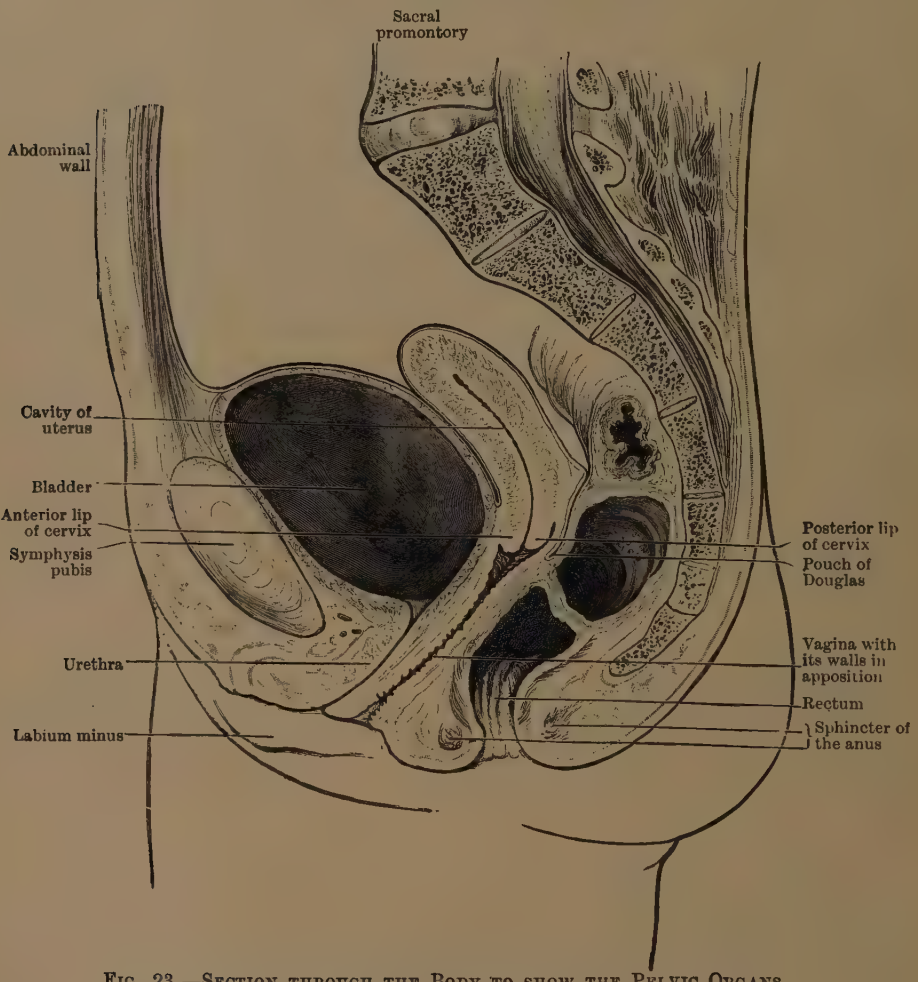
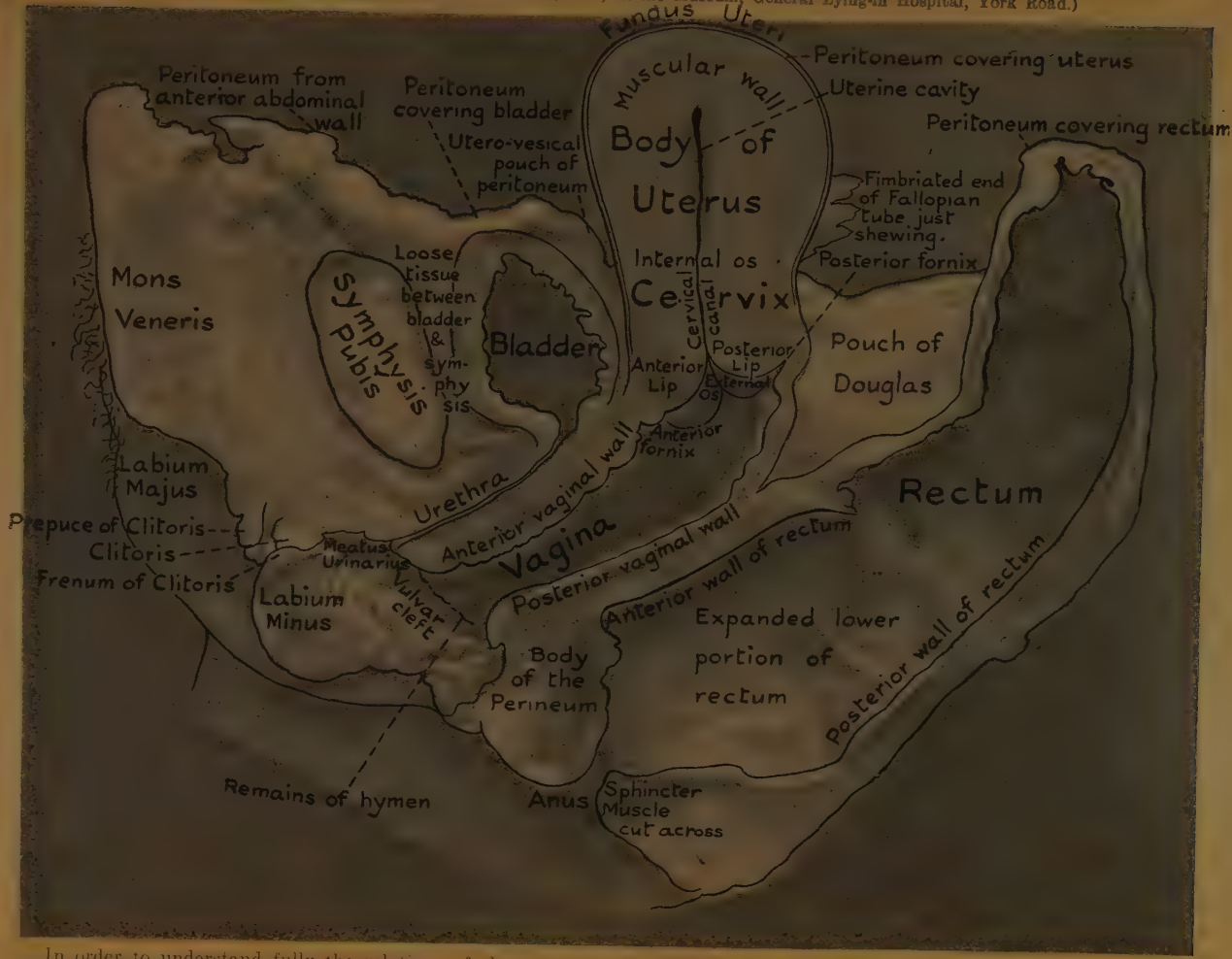


FIG. 23.—SECTION THROUGH THE BODY TO SHOW THE PELVIC ORGANS.

and its appendages, as they appear when removed from the body and dissected. If no preserved specimen or model is available for the student to examine, this description must be followed from the diagrams. Afterwards an attempt must be made to fit the various parts into their positions in the pelvis.

The uterus is divided into (1) the body, (2) the neck or cervix. The body consists of the upper thicker part, while the cervix forms the lower pointed end, which projects into the vagina. From each side of the rounded upper extremity of the body, known as the *fundus* of the uterus, proceed two thin flexible tubes, the *uterine* or *Fallopian tubes*, which open into the uterine cavity. Before describing the cavity of the uterus, the structure of its walls must be briefly sketched. It consists of three layers—an outer very thin covering of peritoneum, a thick muscular layer, and then a thin inner layer of mucous membrane, called the *endometrium*. The whole thickness from peritoneum to endometrium is about half an inch, and quite

(Reproduced from a Photograph of a specimen (No. 3) in the Museum, General Lying-in Hospital, York Road.)



In order to understand fully the relations of the parts to the rest of the body, this plate should be compared with Fig. 23. The vagina, bladder, and rectum have been kept open by glass rods to exhibit their structure better. The dark staining round the uterine cavity shows the part lined by endometrium. It is due to the presence of some blood in the specimen. It serves to distinguish the mucous lining of the body from that of the cervix.

seven-eighths of this belongs to the muscular layer, thus showing the power developed in the organ for the expulsion of the child. The cavity of the uterus is lined throughout with endometrium; there are three openings into the cavity of the uterus—two very small openings at each side of the fundus, which lead into the canal of the Fallopian tubes, and a lower opening leading from the body of the uterus into the canal of the cervix and so into the vagina. The cavity of the uterus is very small; it is somewhat triangular in shape, being widest at the fundus—between the openings into the tubes—and narrowest below at the opening into the cervix. Turn now to the cervix. Its muscular wall is not nearly so thick as that of the body; the mucous membrane lining its cavity (called the cervical endometrium) is different from that of the body, in that it is much folded and contains more glands, which produce mucus and are the chief source of the mucous secretion during pregnancy and of the leucorrhœa or "whites," the discharge which often troubles women, especially those who have had many children. The cervix has (1) an upper opening leading from the cavity of the uterine body, called the internal os; (2) the cervical canal; and (3) the external os, or opening into the vagina. The canal of the cervix from external to internal os measures 1 inch, and that of the body from internal os to fundus $1\frac{1}{2}$ inch, so that the whole uterine canal measures $2\frac{1}{2}$ inches. The wall of the neck of the uterus is thinner than that of the body, and less muscular.

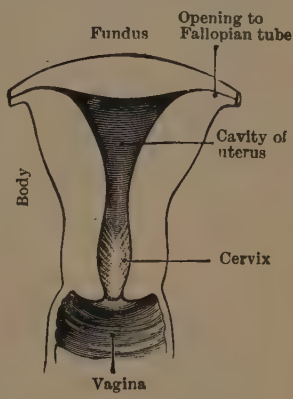


FIG. 24.—DIAGRAM OF THE UTERUS.

The *uterine* or *Fallopian tubes*, which pass out from the right and left corners of the uterus, have also three different layers in their walls, an outer peritoneal coat, a middle muscular coat, and an inner mucous membrane, which is continuous at the openings into the uterine cavity with the uterine mucous membrane. But the muscle of the tube wall is very much thinner than that of the uterus, as strength is not needed here. The tubes are about the thickness of a slate-pencil, and are about $4\frac{1}{2}$ inches in length. They have two openings, one the uterine one already described, and another the abdominal, or fimbriated end, which opens directly into the abdominal cavity, and requires a detailed examination. This opening is surrounded by a large number of fine fringes (hence the term fimbriated) rather like the petals of a flower, or they may better be compared to the tentacles round the mouth of a sea-anemone (Figs. 25 and 26). Its likeness to a trumpet has led to this name being given to it by the French. The function of these tentacle-like processes is to sweep the egg-cells, or ova, as they escape from the ovary into the tube, just as the sea-anemone sweeps in particles of food from the water. The function of the muscular coat of the tubes is to squeeze the egg-cells along the tube into the uterus by its peristaltic contractions (p. 15).

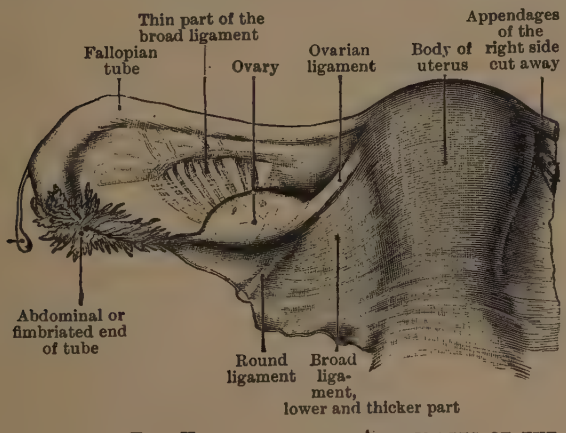


FIG. 25.—THE UTERUS AND THE APPENDAGES OF THE LEFT SIDE SEEN FROM BEHIND.

The *ovaries* are two oval-shaped bodies about the size of a walnut, attached to the posterior surface of the board ligaments a little below the outer part of the Fallopian tube. The fimbriated end of the tube embraces their lower and outer ends, and the longest of the processes, or fimbriæ, usually passes on to the ovary and is therefore called the ovarian fimbria. From the opposite or inner end of the

ovary a thick band runs up to the uterus, just behind and below the insertion of the Fallopian tube, and is known as the ovarian ligament (Fig. 25).

The ovaries contain large numbers of very minute vesicles, about the size of a millet seed, but sometimes larger. These are the Graafian follicles or ovisacs, and each of them contains a minute ovum or egg-cell, less than one-hundredth of an inch in size, and when one of these little vesicles comes to the surface and bursts, the ovum escapes and is taken up by the Fallopian tube.

The last part of the uterine appendages to be described are the broad ligaments. They are simply two thin layers of peritoneum folded over the Fallopian tubes and containing also in their folds and ligaments some connective tissue, a little muscle, and blood vessels. To make the structure of the broad ligaments quite plain, it is only necessary to think of the uterus as having two long arms stretching out from the sides of its upper surface—these being, of course, the Fallopian tubes. Now remember that the peritoneum covers both front and back of the uterus. At the sides it falls over these two arms so as to make the double fold of peritoneum at each side of the uterus which we call the broad ligament. This will also show how the Fallopian tubes run in the upper free margin of the ligament. Between these

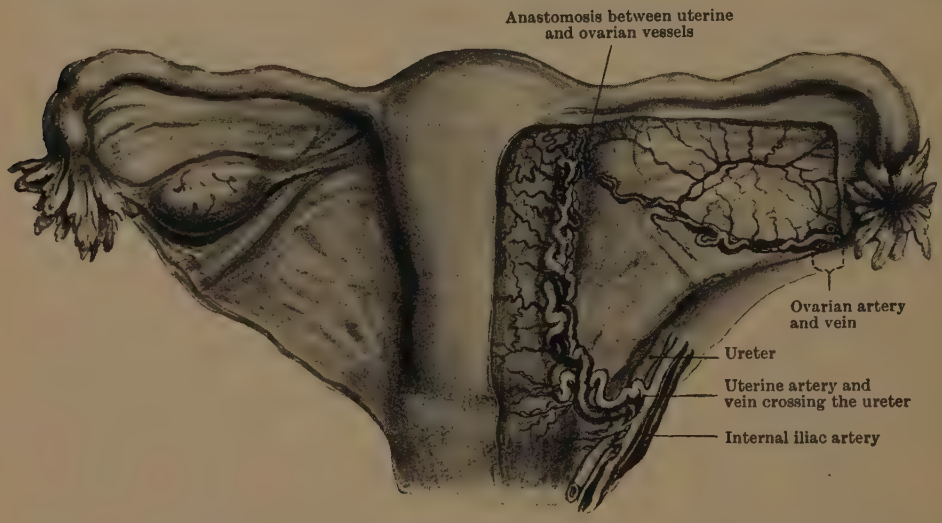

Anastomosis between uterine and ovarian vessels
Ovarian artery and vein
Ureter
Uterine artery and vein crossing the ureter
Internal iliac artery

FIG. 26.—BLOOD SUPPLY OF THE UTERUS AND ITS APPENDAGES.

The ovary and posterior fold of the broad ligament have been cut away on the right side to show the vessels running between the layers of the ligament.

folds are also the ovarian ligament, already mentioned as running between the ovary and the uterus, which forms a projection on its posterior surface, and the round ligament, which runs from the uterus just in front of the insertion of the Fallopian tube by the side of the bladder to the spine of the pubes and from there into the tissues of the labium majus. It causes a projection of the anterior layer of the broad ligament, and is one of the structures by which the uterus is kept in place. Then many arteries and veins run in the broad ligament for the blood supply of uterus, ovaries, and Fallopian tubes. One other fact about the broad ligament may be noted here, and that is—the two folds of peritoneum which form it are very close together just below the tube, where the ligament is so thin as to be almost transparent; but lower down, and as it gets nearer the floor of the pelvis, these folds separate, so that the ligament is thicker below than above. This will be seen to be of some moment in discussing lacerations of the cervix and lower segment of the uterus, for the tearing frequently extends into this broader part forming the base of the broad ligament, and not into the peritoneal cavity.

The blood supply to these organs comes chiefly by two vessels on each side, the ovarian and uterine arteries. The *ovarian artery*, arising from the abdominal aorta, enters the folds of the broad ligament just below the ovary and abdominal

opening of the tube (Fig. 26). It supplies the ovary and uterine tube, and running between the layers of the thin part of the broad ligament below the tube reaches the uterus, supplying the fundus and upper part of the body. The *uterine artery*, coming from the internal iliac artery, turns inwards in the lower thick part of the broad ligament, passing above the vaginal fornix and crossing the ureter, and runs up the side of the uterine body to end below the tube by making connection (anastomosing) with the ovarian artery. It gives branches to the vagina, cervix, and body of the uterus. The blood is drained away by veins which run alongside the arteries.

The nervous supply to the uterus is a complicated one ; it comes in the first instance from a network (plexus) of nerves in the pelvis, which in turn forms connections with the spinal cord and sympathetic nerves.

Nothing further need be added here to what has already been said of the rectum. There now remains only the task of trying to fit all these parts into the pelvic cavity and describing their connections with the peritoneum, but this will be best left till after the external organs have been described.

The External Generative Organs.

The student must now take up the bony pelvis again and endeavour to fit the external parts round the outlet of the pelvis and up into the cavity so as to meet the internal organs, at the point where we left them in the preceding section.

In front of the symphysis pubis is a thick pad of fatty tissue covered with hair, the *mons veneris* ; from it extend downwards along the centre part of the pubic arch two thick folds of skin, the *labia majora* or larger lips, covered with hair on their outer surfaces, but smooth and moist on their inner surfaces. The labia majora enclose the vulval cleft and unite below this, forming the anterior border of the perineum. The *perineum* stretches across the pelvic outlet between the two ischial tuberosities, thus closing in the lower part of the pelvis, and extends back as far as the anus, or opening of the bowel. The point on the pelvis where the rectum opens, the *anus*, is just in front of the tip of the coccyx. The opening is closed by a circular band of muscle, called the *sphincter of the anus*, part of which has an attachment to the last bone of the coccyx (Figs. 29 and 30). The distance between the posterior junction of the labia majora and the anus is about $1\frac{1}{2}$ inch, and that is the length of the skin surface of the perineum. The deep part of the perineum consists of muscular and tendinous structures running across the outlet, and upwards into the pelvis, between the vagina in front and the rectum behind, and will be seen to have considerable importance in supporting the pelvic organs. The smooth inner surfaces of the labia majora come together in front, and so generally conceal the other parts of the external genitals. If the labia majora are opened, two thin pendulous folds of reddish skin are seen, the *labia minora*, whose outer surfaces are in contact with the inner surface of the labia majora, while their inner surfaces are in contact with one another. Passing forwards to just above the pubic arch, each labium minus splits into two branches, which with those of the opposite side enclose a small body, the *clitoris* ; the upper of these two branches forms the *prepuce* and the lower the *frenum* of the clitoris. Posteriorly, the labia minora are smaller and thinner and blend together as a thin band of pigmented skin, forming the anterior edge of the perineum. This thin edge is known as the *fourchette* and is nearly always torn in a first labour. The vertical slit between the labia is the vulval cleft, and in it are the openings of the urethra and vagina. The orifice of the urethra, or *meatus urinarius*, is situated about 1 inch behind and below the clitoris, immediately in front of the entrance to the vagina and below the lower edge of the pubic symphysis. It is surrounded by a prominent elevation of the mucous membrane. Below the meatus is the elliptical opening into the vagina, partially closed in women who have never borne children by the apposition of the edges of a thin membrane, the *hymen*. The hymen marks the division between the external organs, or vulva, and the internal organs. In women who have had children it is represented by small fleshy tags, the *carunculæ myrtiformes*. The triangular area

enclosed between the clitoris above, the labia minora at the sides and the hymen below, is known as the vestibule. The meatus urinarius is just above the centre of the base of this triangle.

It now remains to study the three canals which perforate the pelvic floor and connect the organs in the pelvis with the exterior. From before backwards these are—(1) The urethra, or urinary canal; (2) the vagina, or genital canal; (3) the rectum, or intestinal canal.

The *urethra* is about an inch and a half in length from the meatus to the bladder. From below, it extends upwards and backwards parallel with the anterior wall

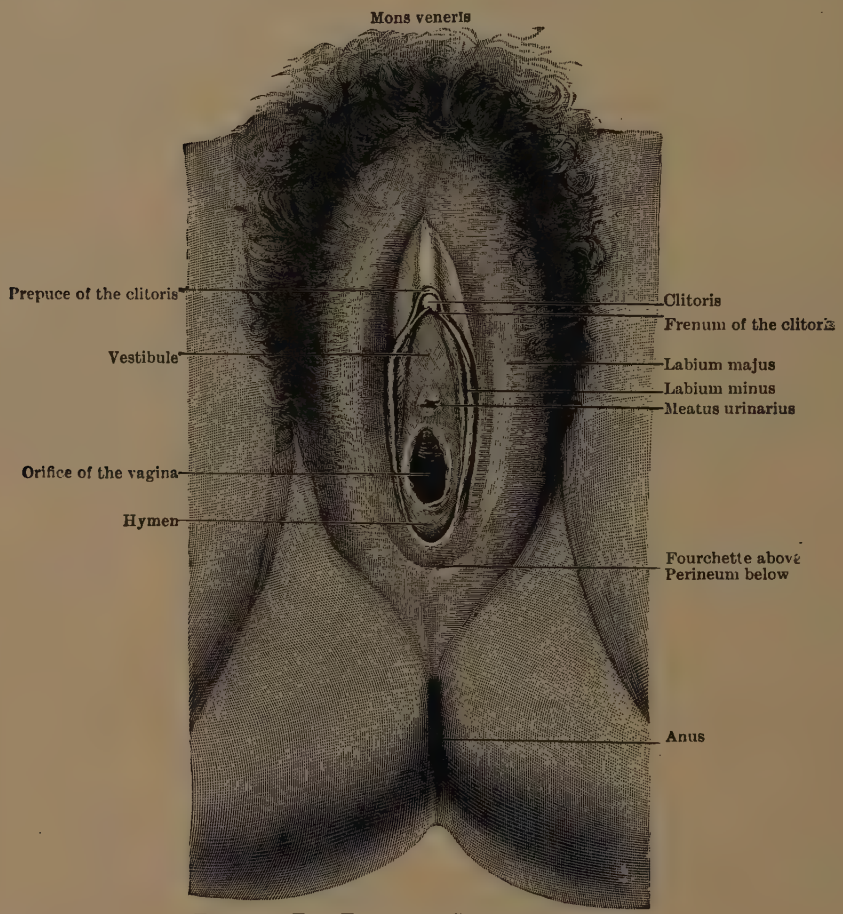


FIG. 27.—THE EXTERNAL GENERATIVE ORGANS.

of the vagina, with which it is closely blended. It is only about a quarter of an inch in diameter, but is capable of great distension, so that it can be dilated sufficiently to allow a finger to be passed into the bladder for purposes of examination without causing more than temporary incontinence.

The *vagina* is a dilatable passage with muscular walls, extending from the hymen to the uterus, the neck of which it surrounds. It passes with a slight curve upwards and backwards, nearly parallel to the plane of the pelvic inlet, towards the sacral hollow, where it expands slightly to receive the cervix uteri. Its upper rounded end embracing the cervix is known as the vaginal fornix. It is divided into an anterior fornix—the portion in front of the cervix; a posterior fornix—the portion behind the cervix and the lateral fornices—to the right and left of the cervix. The anterior vaginal wall is shorter than the posterior. The distance of the anterior fornix from the vulva is $2\frac{1}{2}$ inches, while the posterior is $3\frac{1}{2}$ inches.

To put this in another way, the cervix uteri may be said to be set into the upper part of the anterior wall (Plate I.), while the posterior wall is continued up behind the cervix ; the posterior fornix is thus higher and larger than the anterior.

The relations of the vagina with the other structures in the pelvis are as follows. In front of it are the urethra in its lower part, and the bladder in its upper part. Behind it is the body of the perineum in its lower quarter ; in its middle half it is loosely attached to the anterior wall of the rectum, while the upper quarter is covered by the peritoneum of the front of Douglas's pouch, which dips down from the posterior surface of the uterus to the rectum (Plate I. and Fig. 23). At the sides it is closely covered by the muscles forming the floor of the pelvis, but above the vaginal fornices, at the sides of the cervix, are the bases of the broad ligaments containing the uterine vessels and the ureter. Lining it is a mucous membrane very like skin. Its walls are thrown into thick folds, known as the columns and *rugæ* of the vagina, which are smoothed out by the stretching it undergoes during childbirth, and become much less marked in women who have had many children. The best marked of these folds is the anterior column which runs up just below the urethra. This sometimes becomes so increased in size during pregnancy that it may project at the vulva, and cause the patient some alarm. It must be remembered that ordinarily the anterior and posterior walls of the vagina are in contact, so that there is no actual space or canal (see Fig. 23). The fact that the vulval cleft is vertical, while the vaginal slit is from side to side when its anterior and posterior walls are in apposition, is a matter of some practical importance, and, as will be explained later, is one of the ways in which the uterus is prevented from falling down through the vagina. The last point to be considered with regard to the vagina is the projection of the cervix into its fornix, and the connection between the two. When a vaginal examination is made of a patient who has never been pregnant, the cervix is felt to project into the vagina so that its rounded external os points directly backwards to the hollow of the sacrum ; the cervix feels firm and hard like the cartilage in the tip of the nose. In a pregnant patient the cervix points even more backwards, but is much softer to the touch, indeed quite as soft as the vaginal walls themselves. In patients who have had children its position may be more in the axis of the vaginal canal, and its opening instead of being rounded is transverse, and often lacerated. The vaginal walls pass all round on to the cervix with which they are intimately blended, so that the vaginal surface of the cervix is covered by the same membrane which lines the rest of the vagina.

The *rectum* is narrowest at the anus—it then expands above this into a somewhat large pouch, the anal canal, which in women who are subject to constipation is often full of hard masses of fæces, called scybala. These masses may often be felt projecting into the vagina when a vaginal examination is made. When a rectal examination is made in a non-pregnant female, the cervix uteri can be felt very plainly through the anterior wall, which it sometimes presses in slightly.

Before studying the muscular and connecting structures which bind these organs together and form the pelvic floor, it is necessary to give a sketch of the whole abdominal cavity.[1] The cavity of the abdomen—commonly known as the peritoneal cavity—extends from the diaphragm above to the pelvic floor below. The diaphragm separates it from the cavity of the chest or thorax, in which are the heart and lungs and big blood vessels, and forms a dome-shaped roof to it. Except for the part enclosed by the lower ribs, and by the pelvic bones, and for the vertebral column behind, its walls are entirely muscular ; that is, the diaphragm above, the abdominal wall at the sides and in front, and the pelvic floor below are almost entirely made up of muscle. Hence when these muscles act, as during any straining effort, the pressure inside the whole abdomen is increased, just as it is in the uterine cavity when that organ is in a state of contraction. The whole of the abdomen is lined by a smooth, shiny, thin membrane, the peritoneum. It covers not only its roof and walls, but the organs in the cavity, the stomach, liver, intestines, etc. Now we may look on the floor of the pelvis—which is also the floor of the abdomen and which supports the organs lying in it—as covered internally

[1] Before studying this paragraph the pupil ought to read that part of the Introduction concerned with the anatomy of the abdomen (p. 3).

with peritoneum and externally with skin ; indeed, as formed by all the structures between the pelvic peritoneum and the vulva and skin of the perineum. Therefore the first thing to do is to trace the peritoneum across the pelvis (Plate I. and Fig. 23). Starting from the inner surface of the anterior abdominal wall, it passes on to the top of the bladder and down its posterior wall to the point where the bladder is attached to the front of the cervix uteri. Here it turns up over the uterus and broad ligaments, joining the uterus at about the level of the internal os. In this way it forms a pouch between the uterus and bladder, called the utero-vesical pouch. It is loosely attached to the lower parts of the uterus and bladder, but very firmly adherent to their upper part, this being a provision of nature to allow of the change in size which these organs undergo when they become enlarged from pregnancy or from distension with urine as the case may be. At the sides of the uterus, as has already been described, the membrane passes over the uterine tubes forming the double folds of the broad ligaments, so that the pelvic cavity is in this way divided into an anterior and a posterior half—the bladder being in the front and the ovaries and fimbriated end of the tubes with the rectum being in the back compartment. The peritoneum covers more of the back of the uterus than the front, extending behind right down to the junction of the cervix with the vagina, and then passing

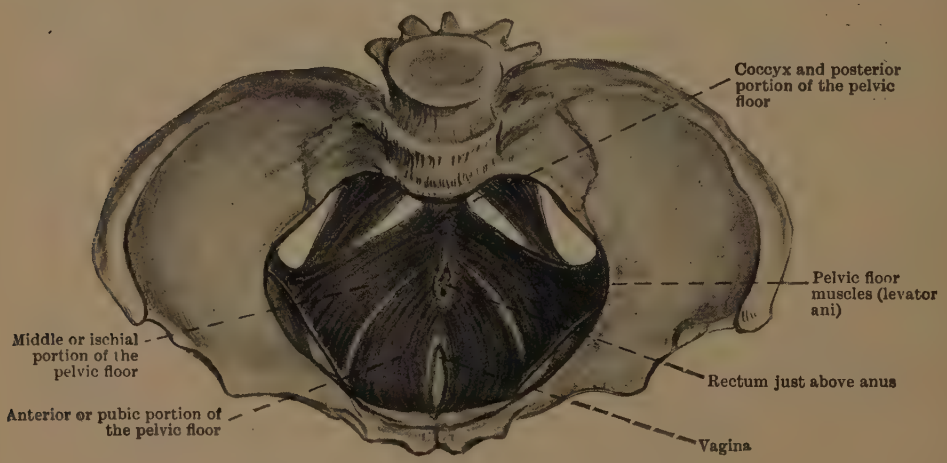

Coccyx and posterior portion of the pelvic floor
Pelvic floor muscles (levator ani)
Middle or ischial portion of the pelvic floor
Rectum just above anus
Anterior or pubic portion of the pelvic floor
Vagina

Fig. 28.—The Pelvic Floor from above.

on to the posterior vaginal wall for the upper quarter of its length, before turning on to the anterior wall of the rectum and so on to the posterior wall of the pelvis and abdomen. The pouch behind is therefore much deeper than that in front, and forms the lowest part of the peritoneal cavity ; it is known as the recto-vaginal fold, or the pouch of Douglas. Sometimes some coils of small intestine may lie in this pouch. It is important to remember that this pocket of peritoneum comes so low down, and that the posterior vaginal wall forms part of its front wall, for if matter collects in the pelvis in consequence of some infection after labour or abortion, it usually gravitates into this lowest part and bulges forward into the vagina, just behind the cervix, so that the surgeon is able to open into the abscess and drain it very easily by simply making an incision through the posterior vaginal fornix. Blood, from a ruptured tubal gestation, and other fluid effusions in the abdominal cavity also tend to collect there. By cutting a piece of cardboard to represent the uterus and broad ligaments and placing it in the pelvis in the axis of the inlet, the pupil will realize how the uterus lies with its fundus just below the pubes and its cervix pointing into the hollow of the sacrum. This position of the uterus is known as one of anteversion, but it varies with the state of the bladder and rectum, with respiration, and with the position of the body ; in fact, the uterus and its appendages are so movable that their position is not constant. In the erect posture the uterus, however, usually lies forwards, in a position of anteversion, so that it rests on the

bladder. In this way there is no actual space between the uterus and bladder, and the much larger space behind the uterus and broad ligaments is usually filled up by coils of small intestine.

The organs in the pelvis are supported by muscular and ligamentous structures, which run across the lower part of the cavity, forming what is often termed the *pelvic diaphragm*, from its similarity to the thoracic diaphragm (Figs 28–30). To obtain some idea of this muscular floor, the student must imagine a thin muscular layer which is attached to the sides of the pelvic cavity a little below the brim, and which passes downwards and forwards, so that the two sides meet and interlace with one another in the middle line. Let her take a half-sheet of notepaper, and put it in the pelvis so that the fold in the middle occupies the bottom of the pelvic cavity, while its top and bottom edges are resting on the sides of the pelvic cavity. That will approximately represent the way the muscular floor is arranged. But it is much more complicated than this. The chief muscle in it, the *levator ani*, passes from the sides

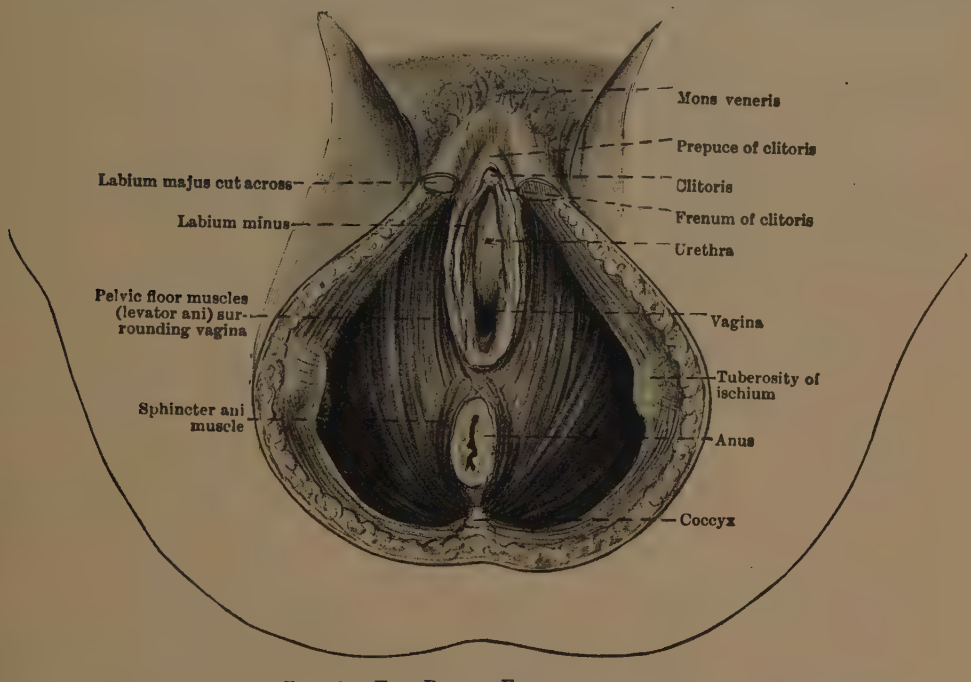


FIG 29.—THE PELVIC FLOOR FROM BELOW.

The superficial perineal muscles have been removed so as to show the muscles surrounding the vagina and rectum.

of the pelvis down into the perineal body, where it interlaces with the muscle of the opposite side, and also spreads round the walls of the rectum and vagina. There are also other muscles which pass across the outlet, from each tuberosity of the ischium, to meet in the centre of the perineum and help to strengthen it. Also, there are strong muscular bands which pass from the lower part of the symphysis, under the bladder and round the upper part of the vagina to the rectum and coccyx to support the organs in front, and to close the vulval cleft. In this way a sheet of muscle and ligament passes irregularly across the lower part of the pelvic cavity and embraces all the organs in it, thus holding them in position. But this sheet is perforated by the three canals which pass through it, just as the diaphragm, which forms the roof to the abdomen, is perforated by the gullet and the big blood vessels. These three canals are : the urethra in front, the vagina in the middle, and the rectum behind. But they are arranged in such a way as to weaken the pelvic floor as little as possible. The urethra in front comes through a strong membrane which runs across the upper part of the pubic arch. The vagina runs through it in a very oblique direction, upwards and backwards, so as to make only a valvular slit. Also its walls are in close contact, so that the pressure from above simply presses the anterior

wall firmly against the posterior, which in turn is supported by the muscles passing into the perineum. The rectum is surrounded at the anus by its sphincter, which binds it to the coccyx behind and to the perineum in front, and above is supported by the muscles passing into it. The pupil will also see how the fact that the axis of the uterus is at right angles to that of the vagina assists in its support. Pressure from above only presses the uterus down so that it lies more over the bladder and

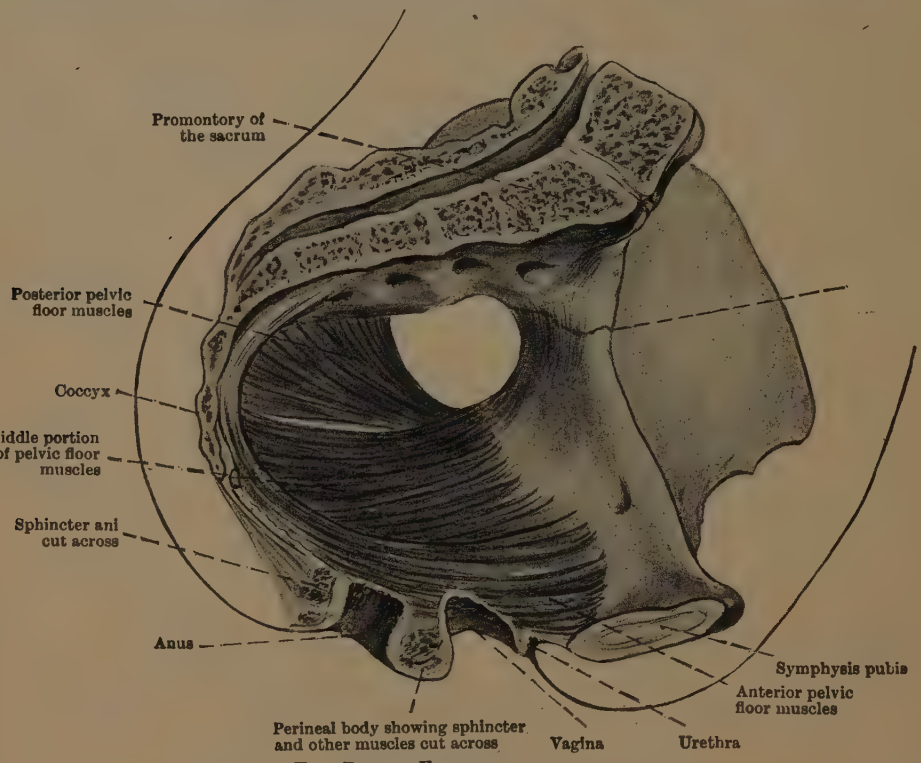


FIG. 30.—THE PELVIC FLOOR SEEN FROM THE SIDE.

The three canals passing through the pelvic floor are seen. The urethra, in front, comes through the subpubic ligament. The vagina, in the middle, passes obliquely through the floor and is surrounded by the most anterior (pubic) part of the levator ani muscle. The rectum, behind, is seen surrounded by the sphincter muscle. The perineal body between the rectum and vagina shows the superficial muscles cut across.

the anterior wall of the vagina. If the uterus lay in the axis of the vagina, it is easy to see how severe straining might press it down that canal towards the vulva.

If this account of the structures of the pelvic floor is understood by the midwife, it will be of immense assistance to her in grasping many points in connection with the mechanism of labour.

CHAPTER III

PHYSIOLOGY OF THE FEMALE GENERATIVE ORGANS.

THE period of reproductive activity of the female organs of generation is marked by a discharge of blood from the vagina, generally at regular intervals of a month. These monthly discharges, the menses or catamenia, commence at the age of 13 or 14 and continue in health, apart from pregnancy and lactation, to about 45 or 50. The time of life at which menstruation begins is known as "puberty," and that at which it ceases as "the change of life," "the climacteric," or more commonly in medical works, as "the menopause" (*i.e.* the cessation of the menses).

At puberty certain changes take place which show that the girl has attained sexual maturity. The establishment of the menstrual flow is an indication that ovulation (the escape of the egg-cell from the ovary) has begun and that the internal organs are developed. The figure becomes more rounded and less angular, due to an increased deposit of fat under the skin and to the breasts becoming larger and more prominent; the full development of the external organs is shown by an increase in size of the labia majora, so that they almost entirely cover in the labia minora, and by the formation of a pad of fat over the pubes, the mons veneris (p. 44), and, later, by the growth of hair over these parts.

Menstruation usually recurs four-weekly and lasts four to six days, but there may be wide variations from this, so that the normal for one woman may be three weeks and for another twenty-four days, and the normal duration for one may be two days and for another over a week, and these remain constant throughout the life of the individual. These differences are so manifold that it may be said that each woman has her own normal, and that only a distinct departure from that normal is to be regarded as an index of something wrong. Healthy menstruation is unaccompanied by pain.

Painful menstruation is known as *dysmenorrhœa*, and if it is enough to cause any disability or trouble should lead to medical advice being obtained. Lack of exercise and constipation aggravate it. A healthy open-air life and good hygiene lessen it. As the midwife is often consulted in regard to these matters, she should have some idea of other conditions for which medical advice is required and of the hygiene of menstruation. They are discussed later (p. 52).

After the menopause, changes in the opposite direction occur. The generative organs atrophy or wither up, as their reproductive life is now over; not only does menstruation cease but there is some shrinking of the vulval opening and vagina, the cervix becomes small and atrophic, and the labia become thin and shrivelled, and the pubic hair sparse.

The **ovary** is the organ responsible for these occurrences in the sexual life of women, and for much that has happened before puberty. The differentiation of the reproductive apparatus and sex characteristics during fœtal development and childhood is due to internal secretions (hormones, cp. Introduction, p. 22), arising in the ovary. Its function may be described as the twofold one of (1) ovulation and (2) internal secretion.

(1) *Ovulation.*—The ovary in fœtal life and at birth contains thousands (estimated at anything from 10,000 to 100,000) of little nests of cells of which but a few hundreds mature to form the ripe follicles or ovisacs that contain the ovum, oöcyte, or egg-cell. In those that ripen the cells multiply rapidly, and one becomes recognizable as the ovum by being much larger than the rest. Fluid forms in the centre of the follicle, distends it, and squeezes the rest of the cells out against the sac-wall. In the ripening follicle (Fig. 31) its wall is lined by a layer of several cells

(the membrana granulosa) with at one spot a heap of cells (discus proligerus) surrounding the large egg-cell. The follicle forms a sac about $\frac{1}{2}$ to 1 inch in diameter and, therefore, readily seen by the naked eye as a small bleb in the ovary. As it enlarges it first approaches, then bulges on, the surface, and finally bursts at its thinnest point, the contained egg-cell escaping into the abdominal cavity. The ovum is there wafted by the fringes surrounding the abdominal opening of the tube into the tube itself, where it is carried by the ciliated epithelium of the tubal mucous membrane towards the uterus.

Fig. 31.—Diagram illustrating the structure of a ripe Graafian Follicle (ovisac).

The ovum is a large cell (nearly $\frac{1}{100}$ inch in diameter, or over 20 times the size of a red blood-cell) with large nucleus (which alone is about 5 times bigger than a red blood-cell); its cell-protoplasm is filled with nutritive yolk-granules.

Following its rupture the small opening in the follicle heals over and the granulosa cells lining its wall increase in number and size, and later turn a yellow colour, thus becoming easily distinguishable in the ovary. It is known as the yellow body, or in Latin, the *corpus luteum* (or to save space as the C.L.). Owing to the growth of the cells occurring within the confined space of the follicle, the cellular layer becomes thrown into folds, so that a ripe C.L. has a yellow convoluted margin with a centre of greyish fluid or blood-clot (Fig. 32). Gradually it shrivels up and finally forms a scar of fibrous tissue (white body or corpus albicans). The C.L. has so important an influence on menstruation and pregnancy, apparently by means of an internal secretion, that it has been termed the "luteal gland."

There is, however, a marked difference in the size and duration of the C.L. if pregnancy occurs. The ordinary menstrual C.L. reaches full development and functional activity within five days of the rupture of the follicle and continues active for about nine days, when it undergoes degeneration, haemorrhage occurring into its fluid centre, and its convoluted margin becoming vivid yellow in colour. It then gradually diminishes in size, and in three months is recognizable only as a yellow spot in the ovary and afterwards as a white scar. Pregnancy delays its degeneration and maintains its growth, so that the pregnancy C.L. is both larger and lasts and functions longer. Its maximum development is not attained till the third month of pregnancy, when it may be over an inch in diameter or twice the size of the menstrual C.L., and its involution is so gradual that at the time of delivery it is still as large as the menstrual at its height and does not disappear till nearly three months after delivery. The significance of these variations will be made clear later.

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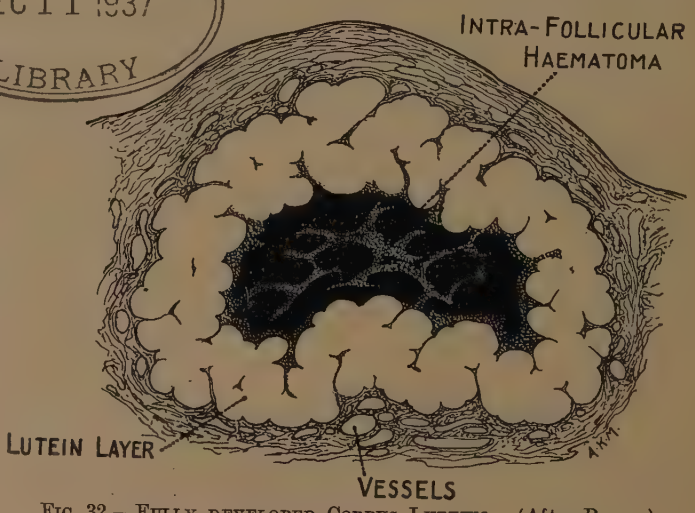

Fig. 32.—Fully developed Corpus Luteum. (After Bumm).

Ovulation occurs in the middle of the menstrual cycle, *i.e.* about the fourteenth day, counting the first day of the flow as the first day of the cycle and the twenty

eighth day as the last of the clear interval. One follicle ruptures, and one C.L. is formed corresponding to each menstrual period.

(2) *Internal Secretion.*—Several hormones arise in the ovary and, so far as our present knowledge will allow, three deserve mention, though possibly there are others.

(*a*) One, probably arising from cells in the wall of the many young follicles that never reach maturity (=interstitial cells) determines the development of the female type of reproductive organs and external genitals, the female type of pelvis and other sex characteristics. Its functions begin in fœtal life, but must continue through childhood and girlhood, and probably till the menopause. Absence of the ovaries or their removal or destruction in early life leads to a cessation of development in the whole reproductive tract and a neutral type of sex character. These results may be obviated by successful grafting of the ovaries elsewhere in the body so that their hormones are still available.

(*b*) Another secretion, possibly arising from the follicles, will produce sexual maturity in immature animals or sexual activity in animals from which the ovaries have been removed. It seems to supply the stimulus that produces ripening of the follicle and ovulation.

(*c*) The secretion of the C.L. appears to be responsible for thickening and other changes that occur in the endometrium before the flow begins, and during pregnancy for the decidual change in the endometrium and the embedding of the fertilized ovum therein, the hypertrophy of the uterus and breasts and the arrest of ovulation.

These different secretions have not been definitely isolated or their exact origin and action proved, and there are possibly more than those mentioned, but the evidence for the above is strong, though further research may show that these views call for much modification. The ovarian hormones require assistance from others, especially those of the thyroid and pituitary. Lack of thyroid in the young, if untreated, results in absence of menstruation and incomplete development of the genital tract as seen in untreated cretins. Treatment of cretins by thyroid extract if begun early will obviate these effects. The anterior lobe of the pituitary gland has a marked influence on genital function; if deficient, there is deficient genital development; if excessive, there is premature sexual development followed by its early decay, shown by the disappearance of menstruation and other sexual functions with a marked deposit of fat throughout the body. The internal secretion of the suprarenal gland (cortical portion) seems to counteract ovarian activity, and its overaction in the female keeps back the feminine characteristics, causing cessation of menstruation and tending to the production of masculine features; deficiency of its secretion allows of predominance of the ovarian, and may result in precocious menstruation. These instances are quoted merely to indicate the dependence of the ovarian hormones for their proper effects on the hormones of other ductless glands. Disordered action of any of them may cause disordered action of the body as a whole, and of the generative system in particular.

The Menstrual Cycle must be regarded as the response to a cycle of events in the ovary of which the menstrual flow is but one part. The lining of the uterus (the endometrium) goes through a cycle, and there are cyclic changes in the whole bodily metabolism of the woman. So far as present knowledge will admit, an explanation will be attempted of these various events in the menstrual cycle, beginning with the changes in the endometrium.

The uterine lining is in a constant state of change throughout reproductive life. With the cessation of each menstrual flow repair begins. The endometrium is then at its thinnest and its gland tubules short and straight. Shortly after ovulation, *i.e.* about the fifteenth to sixteenth days, increase in thickness with secretory activity in the glands is marked, and from the twenty-first to twenty-eighth days there is formed what is known as the pre-menstrual endometrium, which is a mimicry of the decidua of pregnancy, described in Chapter IV. The endometrium is now three or four times thicker than it was at the end of the flow; it has a distinct superficial compact layer and a deep spongy layer; its glands are long and twisted into a corkscrew form; its connective tissue is increased by its cells being increased in number and size and mimicking "decidual cells," *i.e.* they have distinct round nuclei and are

closely packed together. The capillaries are dilated with blood, and the whole mucous membrane swollen and œdematous. About the twenty-seventh day degeneration of the C.L. begins, and is followed in a day or so by the degeneration of the pre-menstrual endometrium which is partly thrown off, together with blood and serum from the oozing surface and mucous secretion from the cervix, forming the menstrual flow. The loss lasts for four to six days, and is followed by the reparative or healing phase with which the description started.

Corresponding cyclic changes occur in the general metabolism of the woman, reaching their height at the time of the pre-menstrual engorgement of the endometrium when the pulse-rate, temperature, blood pressure, and the calcium content of the blood are all slightly raised but fall again when the flow begins. General effects that may accompany these changes are fullness and tension in the breasts, swelling of the thyroid gland and sometimes of the parotid, darkening under the eyes, and other pigmentary changes, and sometimes mental depression and nervous disturbance. In sensitive subjects there may be pains, either local or general, but in healthy women there ought to be no discomfort, certainly nothing to cause interference with their ordinary life.

The ovary initiates the events in the menstrual cycle, and the explanation would appear to be that there is an alternation in that organ from the follicular phase, when ripening and rupture of the follicle is stimulated till ovulation occurs, to the luteal phase, when the C.L. formed after rupture dominates the situation, producing growth and development of the pre-menstrual endometrium and checking follicle development and ovulation. When the C.L. degenerates, so does the pre-menstrual endometrium, and the flow results. The disappearance of the luteal secretion allows the follicular phase to return with follicle ripening and ovulation. If pregnancy occurs, growth and function of the C.L. continue, ovulation ceases, and the pre-menstrual endometrium develops into the decidua of pregnancy.

It is clear that the changes of the menstrual cycle are directed solely towards the reproductive function, and their interpretation would seem to be that there is preparation of the uterine mucous membrane to receive a fertilized ovum, but when impregnation does not occur, there is degeneration and extrusion of the unwanted prepared mucosa, *i.e.* the menstrual flow, after which the process begins again. In other words, the woman menstruates because she does not conceive.

Hygiene of Menstruation.—It is important that the girl—and her mother—should recognize that menstruation is a natural function and not in any way to be regarded as "being poorly" or an incapacity. It ought to be no handicap to the girl or woman, and she ought to carry on with her usual activities, work, or pleasure, the time of the flow in no way differing from any other part of the menstrual cycle so far as bodily health is concerned. Its onset at puberty may be accompanied by irregularity and profuse losses—if so, medical advice should be sought, but once the proper rhythm is established, active exercise in the open air should be encouraged throughout menstruation. A brisk walk is the best preventive of headaches, backaches, and other aches, and breathing exercises and bending movements are useful substitutes when games or other outdoor exercise is impossible. Clothing should be loose to avoid compression of the chest and abdomen and allow free movement of the back. No change in the ordinary rules of cleanliness are called for, and a daily, warm bath should be taken when available, but, if not, the whole body should be washed with soap and water. A hot bath at the onset of flow often relieves discomfort. Constipation must be guarded against, particularly in those whose work is sedentary or involves much standing. Wherever women are employed there should be adequate accommodation for retirement and the changing of diapers, and, if not provided, complaint should be made to the local inspector of factories and workshops.

Absence of the flow, or *amenorrhœa*, is normally present during pregnancy and frequently during lactation also. Ovulation may occur without menstruation, as is shown by pregnancy occurring during the absence of the flow from lactation or disease, but menstruation always ceases with the complete removal of the ovaries, as it does when they atrophy at the menopause. Sudden cessation of menstruation in a healthy woman is nearly always due to pregnancy. In disease and at the time of the menopause it usually ceases gradually. Menstruation may not commence

at the usual age ; when a girl is over 16 without having begun to menstruate, there is possibly some error in the development of the generative organs or in the secretions of those ductless glands that are essential to proper ovarian activity. If there are severe pains without any flow, it may be that the uterus is fully developed, but the vaginal opening is imperforate and the discharge cannot escape. Hence, in any case where a girl has reached the age of 16 or 17 without menstruating, and earlier if she has abdominal pains without discharge, a doctor should be consulted. Certain diseases, especially anæmia and consumption, are often accompanied by cessation of menstruation, and therefore if the woman is not in good health has a pale and bloodless complexion or a bad cough, medical advice ought certainly to be obtained. In some of these cases the flow does not cease, but is slight and pale in colour. Nervous shock and exhaustion is sometimes followed by amenorrhœa.

Excess of the flow, or *menorrhagia*, may be an increase in the amount or in the duration, or in both. When blood clots are formed it usually means that the loss is excessive, as the menstrual blood does not clot normally. Menorrhagia sometimes occurs at puberty with the onset of menstruation, but more often at the menopause just before its cessation ; it may occur as the result of general disease or from disease of the uterus and its appendages ; and in all cases where the loss becomes greater than is habitual with the individual, the matter calls for skilled examination and investigation by a medical practitioner.

Losses of blood between the periods or such irregularity that the woman loses all count as to her periods is termed *metrorrhagia*, and this especially calls for medical examination, as irregular losses are frequently the first sign of cancer of the uterus (p. 331). Any loss after the menopause is almost certainly due to commencing cancerous growth, and many of the cases of metrorrhagia occurring about the time of the change of life are due to the same cause. Increased loss at the periods, and, still more, irregular losses, must never be made light of or neglected by the midwife. " It is not true that ' the Change of Life ' is properly marked by floodings, or by irregular bleedings, or by special discharge of any kind " (C.M.B. Rules, Appendices ; C.M.B. for Scot., p. 72).

The physiology of reproduction—the function of the reproductive system—is completed in later chapters ; it is continued in the next two chapters, and the physiology of labour, the puerperium, the developing child, and lactation are considered in connection with these subjects, because it is better to learn physiology in immediate relation with practical management.

PART II.—PREGNANCY.

CHAPTER IV.

THE PHYSIOLOGY OF REPRODUCTION.

In its essence sexual reproduction is the fusion of two specialized cells (*gametes*, *i.e.* marrying cells) of opposite sexes—the large female gamete (ovum or oöcyte) with the small male (sperm-cell or spermatozoon)—into a single cell (the *zygote* or yoked-cell) which, by its multitudinous divisions and the differentiation of the cells so formed into various types, gives rise to a new individual of the species.[1]

Germ Cells.—Very early in the differentiation of the embryo, certain cells known as *germ-cells* or *germ-plasm* can be recognized as set apart for the next generation, *i.e.* for the perpetuation of the species. They are collected into the sex-glands (gonads), the ovaries in the female and the testicles (testes) in the male, where they lie dormant till sexual maturity is reached, when they undergo certain changes in their nuclear constitution (maturation or ripening), to fit them for reproduction, *i.e.* to become gametes.

The unripe germ-cell contains the same number of chromosomes in its nucleus as the other cells of the body (and the number specific to the animal or vegetable group to which it belongs), and its maturation consists in its casting off half its due quota of chromosomes (one of each pair, cp. p. 5), so that it is then ripe to combine with the gamete of the other sex and thus form a new cell with the full and proper number of chromosomes, half of which has been contributed by each parent-cell.

The process of maturation differs somewhat in the two sexes. The egg-cell by an abnormal division forms a large cell and a small cell, so minute as to be called "the polar body." The mode of division is not only unusual in the size of cells, but also in that each cell is left with only half the chromosomes. Both ripening egg-cell and polar body divide again, the former throwing off another dwarf cell, but this time both in the typical fashion by which each chromosome splits, so that the cell of the division contains the same number of chromosomes as before division. There are thus formed one large ripe oöcyte, the female gamete, with half the number of chromosomes of the unripe oöcyte, and three polar bodies also with half the usual quota of chromosomes. The fate of the three latter is unknown; they seem to disappear and are certainly not fertile cells. In the male a similar unusual process of division of the sperm-cell occurs, in which the proper number of chromosomes is halved, but in this case two equal cells are formed that divide again in the usual manner to form four spermatozoa, each of the same size, each fertile and each with half the original chromosome content. They are the male gametes.

The spermatozoon is very different in appearance from the oöcyte. In shape it is like a minute tadpole, save that its tail is drawn out into a long thread. The head is formed by the nucleus of the cell with a thin film of cell-protoplasm, the rest of which forms the short neck and body and is drawn out into the whip-like tail that forms the greatest part of its length. Its power of movement in fluids is derived from the lashing of its tail. The total length from tip of the nose to tip of the tail is but a quarter of the diameter of the egg-cell, or about the same as that of its nucleus alone. Its business end—its head—is but one-fortieth of the size of the egg-cell or one-tenth of the size of the nucleus of the egg-cell.

Besides differences in size and form there are also great differences in other characteristics. The sperm is a restless creature in constant movement as soon as it leaves the testis, whereas the egg-cell is a stolid, thrifty creature with no inherent power of movement, but dowered with a store of food material in the shape of yolk-granules laid up for future use. The moment the two gametes are married, the spending of the store laid up by the female begins at once in order to pay for the rapid building up of cells that results from the union.

Conjugation, the term applied to the yoking together of the male and female gamete is most readily observed in those forms of life in which it takes place outside the body and in water, such as sea-urchins, starfish, fishes, frogs, etc. Though it has not been observed in human beings, it has in some mammals, and its essential features in widely separated groups of animals are found

[1] Though a good mental exercise and of entrancing interest, the early part of this subject is in no way essential, and is therefore printed in small type like that of the Introduction. It can thus be readily omitted by the beginner and yet be available for those advanced students and those anxious to apply their grounding in physiology to a study of the means by which life is perpetuated. Before studying this section that on the Tissues of the Body and their Growth (p. 4) should be re-read.

to be similar. One sperm and one only by its own propulsive power dives into the egg-cell, losing its tail in the effort. The head, almost wholly nucleus, with the small amount of cell-protoplasm forming the neck and short body, enters the egg-cell and the two nuclei amalgamate into one, the little accompanying protoplasm mingling with the much larger quantity in the ovum. There is thus formed a new single cell, the zygote, differing from both the gametes in that it has the full chromosome content, half being provided by each parent, and with the union has come rejuvenation and that power of growth that is characteristic of young tissues. The absorbing interest in fertilization is in the effort to interpret the significance of the details observed in the preparation of the germ-cells for union, in their union and its consequences. Some of the points that are most striking may be stated briefly.

The *germ-plasm* is in many ways distinct from all other tissues of the body. In the early development of the zygote, three types of cell are early distinguishable—the trophic cells (trophoblast) to nourish the embryo; the embryonic cells (somatic) to form its body; and the germ-cells for its reproduction. The germ-cells differ from the somatic cells in that they have possibilities of perpetuity—of being continued from generation to generation—whilst the body-cells that carry them perish with the body. Another point of distinction is that in their ripening they divide in a manner no other cells do and come to contain but half the number of chromosomes in other cells.

The *chromosomes* appear to be the bearers and transmitters of inherited characters, handed down from a long line of ancestors and to be handed on to a long line of descendants. They are chains of microscopic granules strung together like beads, each of which may possibly represent a factor for some character. The obvious reason for the reduction of the chromosomes in the marrying cells is to ensure the zygote having an equal chromosome representation from each parent. All cells arising from the original zygote will contain the full quota of chromosomes, half being contributed by each parent. The inherited and intrinsic character of the child is, therefore, determined by the chromosomes that go to his making, and at the moment of their union into the zygote, and nothing thereafter can add to or subtract from their sum of inherited qualities. The chromosome constitution of his cells would appear to give to each individual those qualities of body and mind that distinguish one being from another.

The reduction of chromosomes in the gametes also allows of new combinations being made, as the characters thrown off and left in them will vary in nature and strength, thus explaining differences between the children of the same parents.

Not only is the chromosome constitution and thereby the inherited characters fixed at the moment of fertilization, but the sex also. There is a sex chromosome, usually differing from the rest and often unpaired, which determines sex. Those characters that are inherited with sex (sex-linked characters) are also carried in the sex chromosome. In the human species the female has 24 and the male 23 chromosomes, so that the ripe oöcyte has 12 and the ripe sperm 11 or 12, the odd one being present in half only. If a sperm with 11 chromosomes fertilizes the oöcyte with 12, 23 chromosomes will be present in the zygote and give rise to a male; if one with 12, 24 chromosomes will be present and give rise to a female.

A striking point about our knowledge of the transmission of inherited characters is that it was worked out by an Austrian abbot, Gregor Mendel, over sixty years ago, chiefly on plants—peas and such-like—and lost sight of for nearly forty years. His work was rediscovered at the beginning of this century and proved to be correct by further breeding experiments. Since then it has been brought into line with the researches with the microscope on the nuclear changes in the germ-cells. These observations on breeding experiments on plants and animals have been linked up with observations on the minute structure of the germ-cells, and where results obtained from such widely separated aspects point to the same conclusion, they may be accepted as correct. It must surely make every one able to follow even a little of this outline marvel at the wonders of the continuity of life and the start of a new one.

In the higher animals where impregnation takes place within the body, it is preceded by sexual connection or insemination, by which semen containing myriads of spermatozoa is deposited in the vagina, the sperms kept alive in the body fluids, making their way farther up the reproductive tract to fertilize the egg-cell or cells. Actually impregnation may not occur till some days, and perhaps longer, after insemination, for sperms have been found alive in the tube two weeks or more after connection and may be still fertile. The ovum probably cannot remain long capable of fertilization, but there are no data on which to fix a period for its survival, save that its death is supposed by some to cause the degeneration of the corpus luteum that begins about the twenty-seventh to twenty-eighth day of the menstrual cycle, thus giving a possible period of a fortnight.

Development of the Fœtus and Membranes.

Though we do not know for certain, it is very probable that the male element, the spermatozoon, unites with the female element, the ovum, in the uterine tube. The fertilized ovum at once begins to undergo marked changes, dividing and subdividing so that from a minute body of less than one-hundredth of an inch it soon forms a mass of cells (the mulberry mass) which in the course of a few days becomes visible to the naked eye, and in a few weeks forms a mass the size of a pigeon's egg, and in the fullness of time produces not only the child but the greater part of the placenta, the membranes and liquor amnii.

As mentioned in the previous chapter, fertilization leads to greater development of the corpus luteum formed in the ovary. Therefore, instead of breaking down and producing the menstrual flow, the pre-menstrual endometrium progresses and receives a special name, the "decidua," a term signifying that it is "cast off" or "shed" at delivery, like the leaves of "deciduous" trees in autumn. The *decidua* is the greatly thickened pulpy lining of the uterus, which will form the maternal part of the placenta and serve for the growth and nourishment of the ovum. It will be the soil in which the ovum can embed itself and also a protection to the maternal tissues from being eroded. By the end of the third month it is about tenfold the thickness of the post-menstrual endometrium.

If it is examined under the microscope, three layers or strata can be distinguished in it. The surface or innermost layer next the uterine cavity is a firm or *compact* layer, chiefly composed of connective tissue cells closely packed together, so as to resemble an epithelium (*i.e.* "decidual cells"); then comes a *spongy* layer containing large spaces formed by the dilated glands of the endometrium and dilated blood vessels, whilst the deepest layer next the uterine muscle is a thin stratum of almost *unaltered* mucous membrane. Each of these layers has a different purpose. The compact layer serves to support the growing ovum. The spongy layer with its blood spaces forms the chief nutritive layer for the ovum, which, so to speak, sends its roots down into these spongy spaces and sucks up nutriment from the maternal blood. The deepest part of the spongy layer next the unaltered layer forms the line through which the membranes tear when they are separated at birth. It has been compared to the line of perforations round a postage stamp; all the structures internal to it are cast off, so that there is left in the uterus only the thin unaltered layer from which the new lining to the uterus is regenerated during the lying-in period.

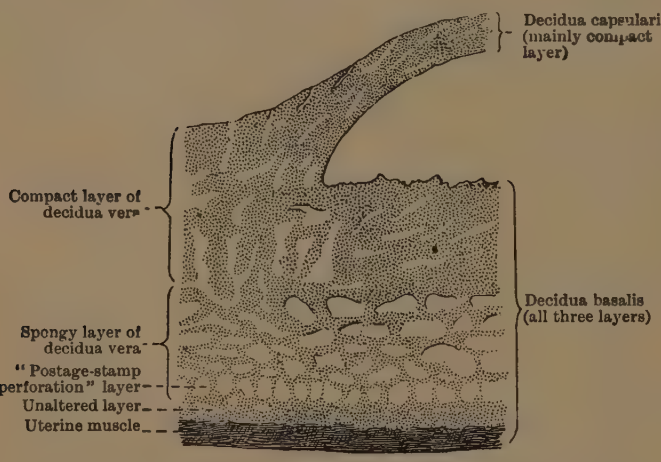

FIG. 33.—SCHEME OF DECIDUA TO SHOW ITS THREE LAYERS.

This diagram shows what might be seen on microscopic examination of the junction of the decidua basalis and capsularis. The three layers are best seen in the decidua vera on the left-hand side. The compact layer on the surface, then the spongy layer, and, next the uterine muscle, a thin layer of unaltered endometrium. The deepest part of the spongy layer is described as the "postage stamp perforation layer," as through it the placenta and membranes separate at birth, leaving the unaltered layer next the muscle.

Implantation or embedding must take place within about ten days after fertilization. Up to then, nutriment necessary for the growth of the fertilized egg-cell is provided by the yolk-granules in the cell and by absorption of fluid from the genital tract (*e.g.* secretion of the uterine glands), but better provision is now necessary. By this time fluid has formed in the mulberry mass and produced an oval cyst, the *blastocyst*, with one end distinct from the other by having a thick inner mass of cells, and it is this pole that goes in first and becomes the entering pole. Also cell-differentiation can now be recognized in the blastocyst as its surface is found to be covered by a double layer—an *outer* irregular mass of protoplasm studded with nuclei but with no cell-wall or divisions into individual cells, known as *syncytium* (a word meaning "cells run together"), and an *inner* of distinct and separate cells. These two together are termed the *trophoblast*, or nourishing tissue, to express their function. The syncytium has the power of eating away the tissues, like that of the phagocytes or "devouring cells" of the blood, described on page 27 of the Introduction. By

means of its covering of syncytium, the entering pole of the blastocyst eats its way into the compact layer of the decidua until the tiny vesicle is completely enclosed, the aperture by which it entered being at once closed by the cells of the other pole plugging it (Figs. 34, 35, and 36).

The ovum generally bores its way into the soft decidua somewhere in the upper part of the uterus. This is of importance, as the part where it settles forms the future placental site, and the complication known as placenta prævia will be produced if the ovum imbeds itself in the lower part of the uterus and a low insertion of the placenta occurs. Having sunk into the decidua, the ovum now rests on the spongy layer and is covered by a cap of compact layer which becomes stretched out and bulges into the cavity of the uterus. Different names are applied to the decidua according to its relation to the developing ovum. Thus the general decidua lining the cavity is termed the *decidua vera*. The part on which the ovum rests, which later will become the maternal part of the placenta, is called the *decidua basalis*. The part stretched out over the ovum, which covers and supports it during its early growth, is termed the *decidua capsularis* (Figs. 37–8). As the ovum enlarges the capsularis will become thinner, and when it has bulged out so far as to reach the opposite side of the uterus, the capsularis will be pressed against the vera, so that it ultimately blends with it.

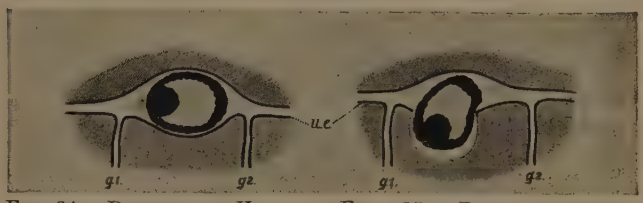

FIG. 34.—DIAGRAM OF HUMAN EMBRYO FREE IN THE UTERINE CAVITY. (Teacher).

The oval blastocyst is seen with its outer layer of trophoblast, the inner cell-mass at one pole, and cavity containing fluid.

g_1 and g_2. Uterine glands.

FIG. 35. — DIAGRAM OF THE BLASTOCYST EMBEDDING ITSELF IN THE DECIDUA. (Teacher).

The pole containing the inner cell-mass goes in first so that it comes to rest on the basal decidua.

u.e. Uterine epithelium.

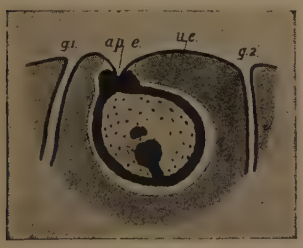

FIG. 36.—DIAGRAM OF BLASTOCYST AFTER EMBEDDING. (Teacher.)

The embryonic area is now raised up by the ventral stalk and the trophoblast cells at the opposite pole have proliferated and spread underneath the uterine epithelium so as to close the aperture of entrance.

ap.e. Aperture of entrance.

By the end of the third month the ovum has increased so much that it fills up the whole uterine cavity; the decidua capsularis is everywhere blended with the decidua vera, and can no longer be recognized as a separate layer—indeed it is no longer required to support the ovum, for the ovum is now supported by the uterine walls on all sides, and is expanding the uterus. From this time onwards the decidua capsularis and vera are compressed and thinned, till at birth they can only be seen as mere shreds on the surface of the membranes.

Turn now to what has happened to the ovum[1] within its decidual covering whilst it has grown from its original minute size till it is big enough to fill the whole uterine cavity. Just as a seedling plant begins by making a very extensive growth of roots, so as to have the means of obtaining nourishment from the soil, so by far the greater part of the young ovum is taken up with the formation of those structures which attach it to the mother and serve for its nutrition; only a very minute part represents the commencement of the *embryo*, as the early fœtus is called. The ovum forms itself into a small bag in which the embryo hangs by a little stalk, the outside of the bag being covered by a shaggy membrane formed largely from the trophoblast, known as the *chorion*, so that it has the appearance of a minute woolly ball. The shaggy pro-

[1] The pupil will note that the term ovum is used in two different senses: first, as one of the ova or egg-cells discharged from the ovary; secondly, as the zygote or fertilized ovum throughout its development, so that it includes the fœtus, placenta, membranes, liquor amnii—in other words, all the fœtal products of conception.

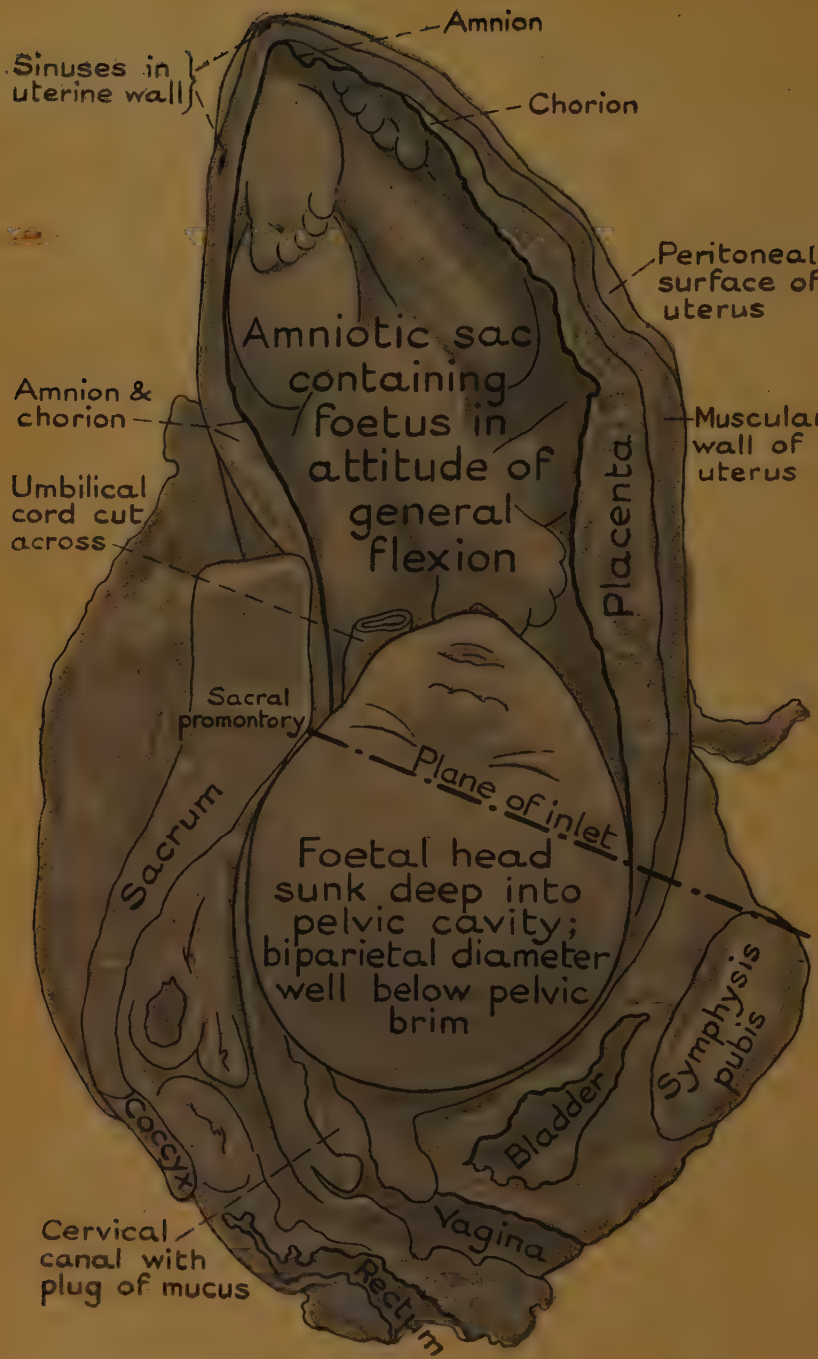

PLATE II.

SECTION OF PELVIS AND FULL TIME PREGNANT UTERUS, WITH FŒTUS.

(Reproduced from a Photograph of a specimen (No. 6) in the Museum, General Lying-in Hospital, York Road.)

to and from the placenta. This stalk increases in length and becomes the umbilical cord. The outer membrane is the chorion, blended with the remains of the decidua, except at the site of implantation, where the fleshy mass of the placenta takes its place (Fig. 39).

To make the anatomy of the ovum quite plain, let us trace the various structures met with from the uterine wall without to the fœtus within, in a pregnancy of the later months. This ought to be done from two different points : (1) opposite the site of implantation of the ovum ; (2) through the implantation or placental site (see Plates II. and III. and Fig. 40.)

The structures met with in the first case are, *peritoneum* covering uterus, *muscular wall* of uterus, *decidual layer* consisting mainly of decidua vera, but also of the very thin remains of the decidua capsularis, *fœtal chorion* from which the villi have disappeared, *amnion*, *amniotic sac* containing the *liquor amnii*, and in the last the *fœtus*.

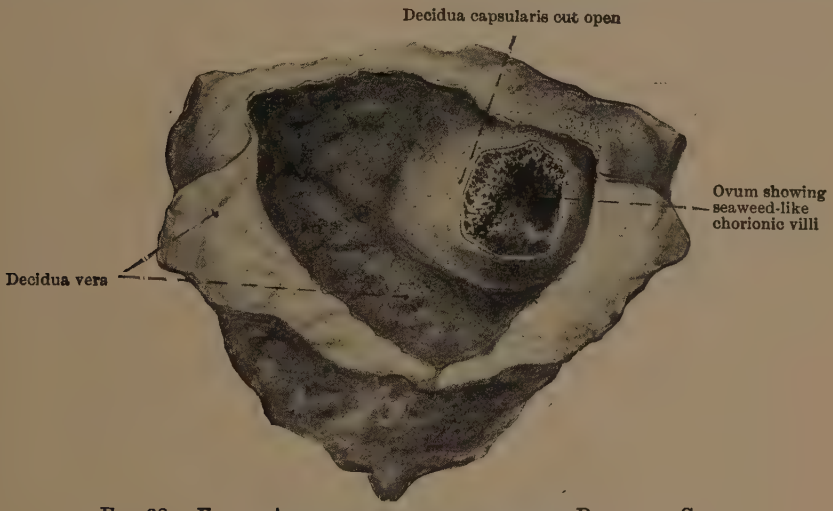

FIG. 38.—EARLY ABORTION, SHOWING COMPLETE DECIDUAL CAST OF THE INTERIOR OF THE UTERUS.

(St. Thomas's Hospital Museum.)

This specimen shows an early abortion consisting of the decidual lining of the uterus with an ovum implanted in the upper part. The cast has the triangular shape of the uterine cavity ; above, at each corner, is the opening of the Fallopian tube, and below, the internal os. The outer surface is formed by the deep part of the spongy layer. The decidua vera has been opened to show the interior. The ovum resting on the decidua basalis and covered by decidua capsularis is seen. A window has been cut in the decidua capsularis to show the seaweed-like chorionic villi of the ovum within.

The structures met with in the second case are the *peritoneum* and *muscular wall* of the uterus as before, then a layer of *decidua basalis* forming the *maternal part* of the *placenta*, then the *fœtal part* of the *placenta* formed of masses of branching villi growing from this part of the *chorion*, then a layer of *amnion* lining the fœtal surface of the placenta, the *umbilical cord*, running from the placenta through the amniotic sac to the umbilicus of the fœtus, and again, as before, the *liquor amnii* and *fœtus*.

Thus far, in studying the anatomy of the fœtus and its membranes the pupil will have to depend on diagrams, but in all the larger and properly equipped training schools she will be able to examine prepared specimens in museums. It is particularly important to study a series of early abortions (as illustrated) so as to understand the way the after-birth is formed. Now that the ripe placenta and membranes are to be considered, she must go through the rest of this chapter with the after-birth in front of her. It is quite easy to obtain one in the course of her work, and it is absolutely essential that she should make the most of her opportunities by verifying all she reads by actual examination of the placenta and membranes as they are shed at the end of labour.

Float the placenta in a basin of water with the membranes uppermost, and arranged so that the cord lies inside the bag. In this way the maternal surface is outermost, as in the mother, and the student looks into the amniotic sac through the hole in the membranes by which the child escaped. As a rule, this opening is at the opposite end of the bag to the placenta—in other words, the placenta is situated in the upper segment of the uterus, and the rupture takes place in that portion of the membranes which presents at the os uteri. This is shown by the two being nearly at opposite poles of the sac, though not quite, as the placenta is generally attached, not absolutely to the fundus but somewhat below it. By examining the site of rupture, then, an idea may be obtained of the distance of the attachment of the placenta from the os uteri (see chapter on Placenta Prævia, p. 208). Examine the membranes first, as they are simpler to understand than the placenta. The inner or fœtal surface of the thin membranes will be seen to be smooth and shiny, while the outer or maternal surface is rough and of whitish fibrous appearance. On further examination it will be found that the outer rough membrane is quite distinct from the inner smooth one, and can, with little difficulty, be stripped from it right up to the edge of the placenta with which it becomes continuous. This is the *chorion*, together with the decidua. The greater part of it is fœtal chorion, but sometimes a few fine reddish shreds may be seen on its surface, representing the maternal decidua or that part of the uterine lining superficial to the spongy layer through which separation has taken place. If an opportunity is obtained to examine the membranes from a premature birth, this decidual layer will be better seen. At full time it has been so compressed by the growth of the ovum that very little of it can be identified. The tougher *amnion* can be traced right round the sac, covering the fœtal surface of the placenta, and continued over the umbilical cord. It extends as the outer layer of the cord right up to the umbilicus of the child, where it becomes continuous with the skin of the abdominal wall. Note that it can be easily stripped off the surface of the placenta.

Chorion showing atrophic villi (from under decidua capsularis)
Amnion
Amniotic sac containing embryo
Mass of chorionic villi (over decidua basalis)

FIG. 39.—EARLY ABORTION.

(From a specimen in St. Thomas's Hospital Museum.)

This shows a small embryo in its amniotic sac. On the outer surface of the sac is seen the chorion. When implanted in its decidual bed the shaggy mass of chorionic villi over that portion of the sac to which the primitive umbilical cord runs, will be implanted in the decidua basalis forming the fœtal part of the placenta; the chorion over the upper part of the sac, *i.e.* the part covered by the decidua capsularis, is atrophic and shows only a few withered-up villi. This figure should be compared with Fig. 40, which shows an ovum of later development implanted in the uterus.

The placenta must now be examined. It is a fleshy cake-like mass, weighing about 1 lb., more or less circular in shape, its diameter measuring about 7 or 8 inches. It is thickest in the centre—about $1\frac{1}{4}$ inch—and thins away slightly towards its edges, which are continuous with the united chorion and decidua already described. The *outer* or *maternal surface* is rough and irregular, as it has been torn off from the uterine wall at the end of labour; it is of a fleshy red colour, and is divided by small furrows into lobules, sometimes called *cotyledons*. The torn openings of vessels can be seen on this surface, and, by squeezing, blood of a dark colour will be expressed from them. This is maternal blood which has been circulating through the placenta. This surface of the placenta is formed of maternal decidua (decidua basalis) which covers in the villi. The *inner* or *fœtal surface* is covered by the amnion, which can be stripped off it quite easily; the umbilical cord is usually attached somewhere near its centre, and the fœtal blood vessels can be seen through the transparent amnion spreading out from the insertion of the cord like the roots of a tree and passing down into the cotyledons of the placenta. These vessels radiating from the cord will be noticed to run in pairs, an artery and a vein, taking the fœtal

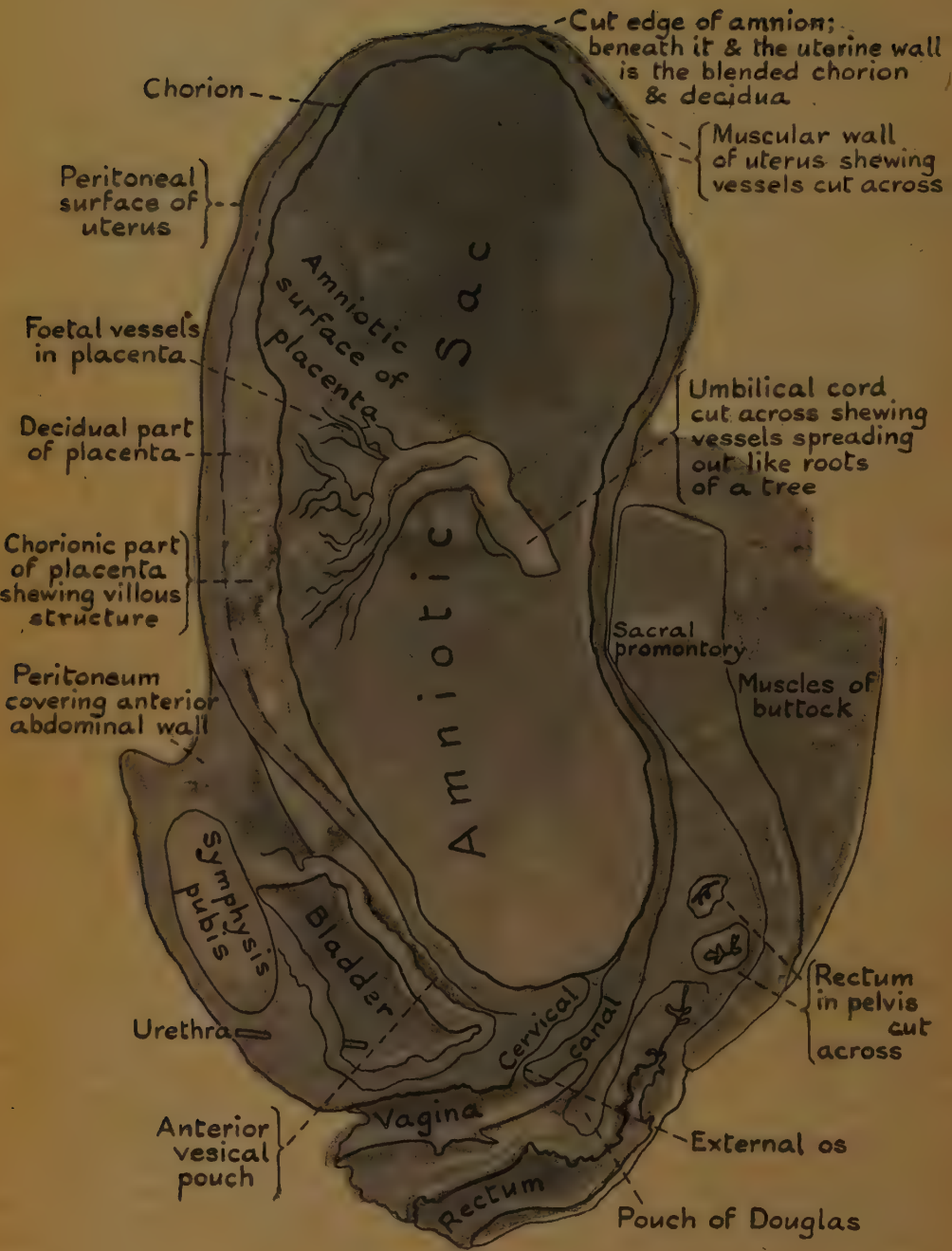
Cut edge of amnion; beneath it & the uterine wall is the blended chorion & decidua
Chorion
Muscular wall of uterus shewing vessels cut across
Peritoneal surface of uterus
Amniotic surface of placenta
Amniotic Sac
Foetal vessels in placenta
Umbilical cord cut across shewing vessels spreading out like roots of a tree
Decidual part of placenta
Chorionic part of placenta shewing villous structure
Sacral promontory
Muscles of buttock
Peritoneum covering anterior abdominal wall
Symphysis pubis
Bladder
Urethra
Cervical canal
Rectum in pelvis cut across
Anterior vesical pouch
Vagina
External os
Rectum
Pouch of Douglas

PLATE III.

SECTION OF PELVIS AND FULL TIME PREGNANT UTERUS, THE OTHER HALF OF THAT SHOWN IN PLATE II.

(Reproduced from a Photograph of a specimen (No. 7) in the Museum, General Lying-in Hospital, York Road.)

blood to and from the placenta. In order to obtain some idea of the structure of the placenta, the student must make a cut right through it from the insertion of the cord to its outer edge, and then wash out as much of the blood as she can from its meshes. This is best accomplished by holding the cut surface under a stream of water from a tap, and at the same time squeezing out the blood from the substance of the placenta. Here and there will be noticed thicker strands, formed by the biggest stems of the villi, and between the cotyledons, fibrous septa dipping in from

Decidua vera
Decidua capsularis blended with fœtal chorion and amnion
Amniotic sac from which fœtus has been removed
Decidua vera separated from uterine wall
Internal os and cervical canal showing arbor vitæ
External os
Vagina
Peritoneum covering uterus
Muscular wall of uterus
Chorionic villi blended with decidua basalis to form the placenta
Amnion covering placenta

FIG. 40.—SECTION OF PREGNANT UTERUS (11TH WEEK).

(St. Thomas's Hospital Museum.)

In this specimen the ovum has not yet reached the size when it fills the whole uterine cavity. There is still a clear space between the decidua capsularis covering the ovum and the decidua vera on the opposite wall of the uterus. In another week the capsularis will be in contact with the vera, and the two will be compressed and thinned by the growth of the ovum so as to be scarcely identified. Inside the capsularis is seen the amniotic sac from which the embryo has been removed. Under the capsularis the chorion is so thin and atrophic that it can scarcely be recognized. Over the basalis the chorion forms a mass of villi, which, blending with the basalis, forms the placenta. The decidua vera has been artificially separated from part of the uterine wall. This figure should be compared with the full-time uterus shown in Plate III.

the maternal surface, representing portions of the decidua basalis, which support and bind together the masses of villi. Each cotyledon of the placenta is the area of branching villi served by a main stem of the fœtal villous circulation. By following down a large branch till a small one is reached, and cutting it out with its attached placental tissue, the arrangement of the villi can be readily demonstrated. If this bit of placental tissue is held by the vessel as a stalk, and teased out under water, or squeezed flat between the fingers, the villi of the organ will be seen, if floated in clean water, as a dense network of branching threads, very like fine seaweed (Fig. 41).

When the student has made out all she can from a study of the actual organ, she ought now to try and understand its structure more exactly by comparing it with the diagrams and by following the course of the fœtal and maternal blood streams through it, so as to obtain a proper conception of the way its functions are carried on.

Begin with the maternal blood stream. The placenta is often likened to a sponge, and the comparison is an apt one, for the spaces between the masses of branching villi are filled with blood from the maternal circulation. The blood which was washed out of the organ during its examination was the blood from the mother which bathes the villi. The decidua basalis is hollowed out into large spaces, divided up by the septa of the cotyledons and by the villus-stems, into which blood enters from the uterine arteries, and after circulating among the villi returns to the mother again by the uterine veins. The uterine arteries run through the walls of the uterus in a coiled or cork-screw-like course, and, becoming thin-walled, pass through the decidua and open into the blood spaces or sinuses of the placenta. The veins taking the blood back from the intervillous spaces open obliquely through the decidua into the veins in the uterine wall. This, then, is the course of the maternal blood stream—the purified blood is driven by the mother's heart through the coiled uterine arteries into the intervillous blood spaces of the placenta, where it bathes the finest processes of the villi, is collected again from there by the veins in the uterine wall and returned to the mother for further purification.

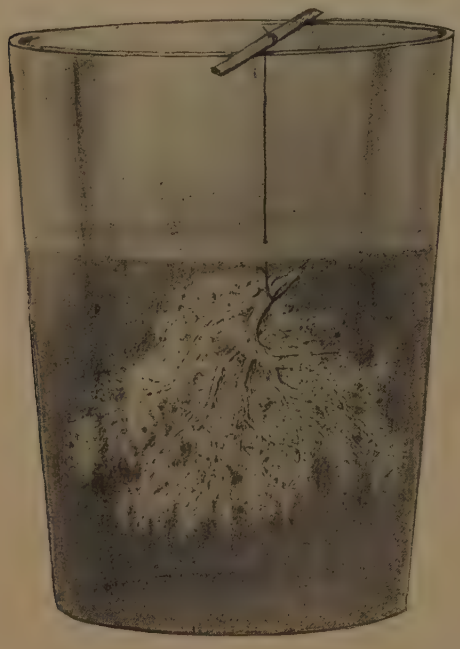

FIG. 41.—TEASED PLACENTA FLOATED IN WATER TO SHOW CHORIONIC VILLI.

A vessel with its attached tissue has been cut out of the placenta, squeezed between the fingers, and teased out with a needle. On floating the teased tissue in water the branching villi are seen to have the same seaweed-like appearance as in an early abortion. The branching villi from the mature placenta should be compared with those seen in the early abortions (Figs. 33, 34, and 35); they will be seen to present similar characteristics.

Now turn to the fœtal blood stream. The blood from the arteries in the umbilical cord reaches the fœtal surface of the placenta in the vessels seen under the amnion, spreading out like the roots of a tree and dipping through into the deeper parts of the placenta; there they break up into smaller and smaller vessels until, finally, their minute end branches run up the finest villi and spread out at their end in a capillary network. At this point the blood in them is only separated from the maternal blood by very thin membranes, in fact only by their own lining and the lining of the villus, and through these thin linings exchange of material between the fœtal blood and the maternal blood can take place. The fœtal blood thus purified and strengthened now comes back by veins from the villi, and is collected into bigger veins by joining with others, so that by the time these veins appear on the fœtal surface of the placenta they are seen to be branches of the umbilical vein underneath the amnion, corresponding to those of the umbilical arteries already noted. These tributary veins unite at the insertion of the cord into the umbilical vein, which passes back by the cord to the fœtal heart, where the blood it brings is pumped to all parts of the fœtus. The course of the fœtal blood stream through the placenta is: the impure blood is driven by the child's heart through the coiled arteries of

the umbilical cord to the placenta, where it is distributed in minute vessels to the ends of the villi, and there is enabled to effect exchange of material with the blood of the mother; it is collected again by the veins coming back from the villi and returned, purified and strengthened, to the child's heart by the umbilical vein.

Sometimes an isolated island of placental tissue is found detached from the main placenta, known as a *succenturiate* placenta. Its chorionic villi have remained active and obtained attachment to the decidua. As there must be a fœtal circulation to these villi, in order to maintain their activity, such an isolated bit must have a vascular connection with the fœtal vessels in the cord, and therefore, if examined carefully, some vessels will be seen running under the amnion from the detached portion to the main placenta and so to the umbilical cord.

From the foregoing it is evident that the placenta is the organ by which the blood of the fœtus is brought into relation with that of the mother. No direct mixing of the two bloods takes place. The fœtal blood is always kept separate from the maternal blood by thin membranous coverings, but these are so delicate that they allow of interchange of gases and substances in solution in the bloods to

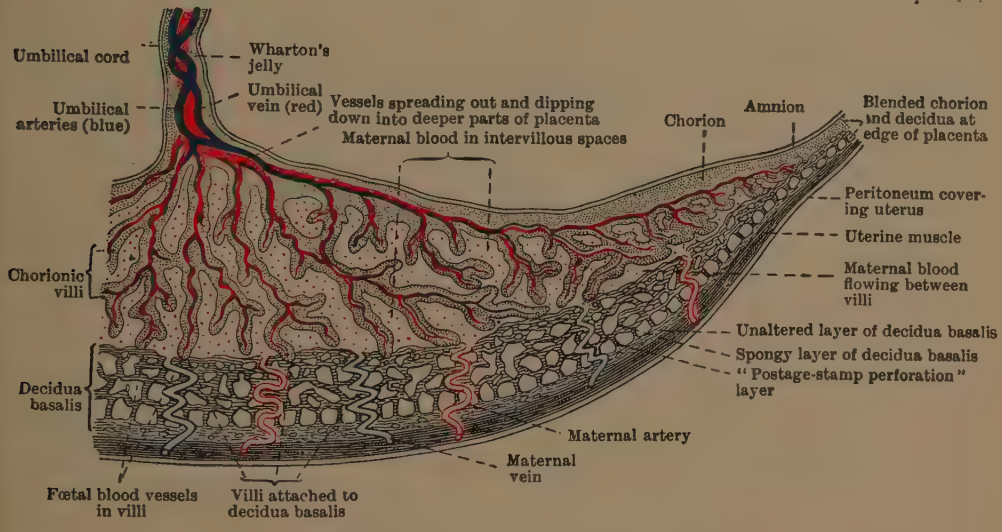

FIG. 42.—SCHEME OF THE PLACENTAL CIRCULATION.

The umbilical arteries are marked in blue because they carry the impure blood to the placenta; the veins which bring back the purified blood are shown in red. The pure maternal blood comes into the placenta by the maternal arteries shown in red; the impure maternal blood returns by the maternal veins shown in blue. The maternal blood between the villi is stippled red. The next figure illustrates the detail of the villous circulation.

take place through them. This naturally leads to mention of the functions served by the placenta in the nourishment and development of the fœtus. These functions are of three kinds—respiratory, nutritive, excretory.

1. *Respiratory.*—It purifies the fœtal blood by allowing it to get rid of its carbonic acid and supplying it with oxygen—in fact it serves as lungs to the child. Indeed, very similar physiological processes take place in the lungs and placenta. In the lungs (Introduction, p. 12), the venous blood returned from the body is pumped there by the right side of the heart and spread out in minute capillaries in the walls of the lungs, where it is only separated from the air drawn into the lungs by very thin and delicate membranes, namely, by the lining of the capillary vessels and the lining of the air-cells of the lungs, and through these the interchange of gases between the blood and the air takes place. The blood gets rid of its carbonic acid to the air, and the air gives up oxygen to the blood. The oxygenated blood returns to the left side of the heart to be pumped over the body, while the used-up air is expelled from the lungs by the act of expiration. The process is exactly similar to that which takes place in the placenta, except that in this case the exchange is between the impure blood of the fœtus and the oxygenated blood of the mother,

instead of between the impure blood and the oxygen of the air drawn in by inspiration. In other words, the mother's blood acts as a go-between; it is oxygenated in the mother's lungs, and there gets rid of the carbonic acid both from the fœtus and mother, and carries the oxygen, which has to serve the tissues of both mother and fœtus.

2. *Nutritive.*—It is the means by which the fœtus obtains the materials necessary for its growth and nourishment—in fact, it serves as digestive tract to the child. The fœtal blood absorbs from the maternal blood, water and salts in solution, such as lime salts and phosphates for the bones, soda and potash salts for its tissues, and so on. Also, it obtains albuminous or proteid matter, fats, sugar, and such other substances as are necessary for its proper nourishment. Here also, then, the mother's blood acts as a go-between. The mother absorbs these substances from her in-

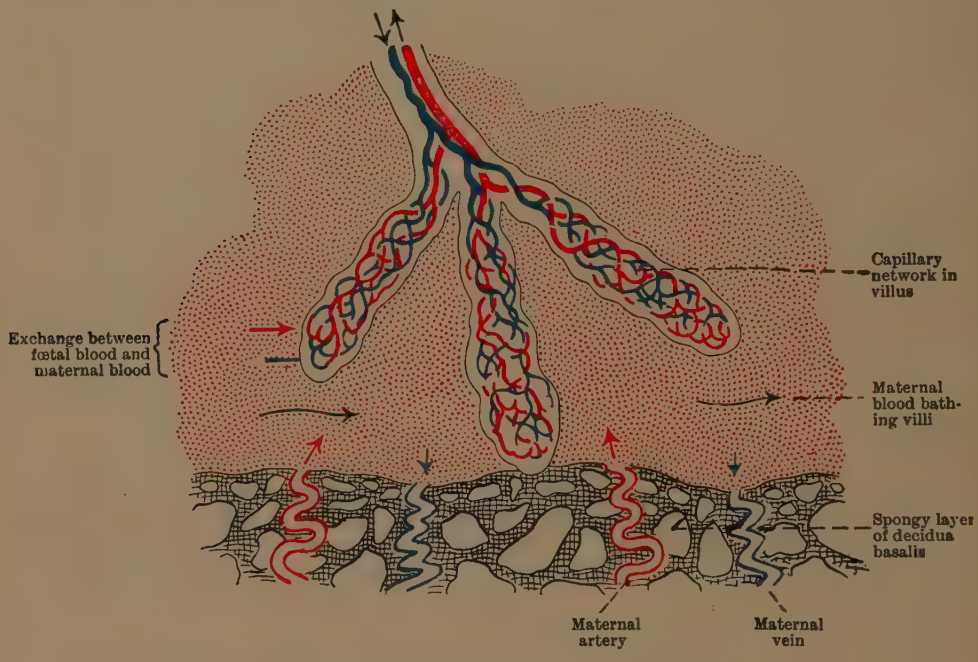
Capillary network in villus
Exchange between fœtal blood and maternal blood
Maternal blood bathing villi
Spongy layer of decidua basalis
Maternal artery
Maternal vein

FIG. 43.—SCHEME OF THE VILLOUS CIRCULATION.

This diagram shows in detail the capillary circulation in the villi. The arrow pointing down the stem of the villus indicates the impure fœtal blood from the umbilical artery passing down to the capillary network of the villus. The blue arrow from the tip of the villus indicates the passage of waste products to the maternal blood circulating between the villi; the red arrow the taking up of oxygen and food material. As a result of the exchange between the fœtal and maternal blood, the fœtal blood, purified and strengthened, returns to the umbilical vein as shown by the arrow pointing up the stem of the villus. The large black arrow indicates the flow of the maternal blood. The red and blue arrows above the maternal vessels indicate the in- and outflow of maternal blood to the placenta. The colours of the vessels, etc., as in the preceding figure.

testinal canal, the water she drinks and the food she eats are prepared in her stomach and intestines and absorbed from there into her blood, and it, in turn, gives up to the fœtal blood what is required for the child through the placental circulation.

3. *Excretory.*—It acts as the excretory organ of the child, or the means by which the waste products of its body are got rid of. It carries on the functions which the kidneys and liver perform after birth. The waste substances which the kidneys extract from the blood and pass away in the urine, are passed through the villi into the maternal blood, and it, in turn, gets rid of them through the kidneys of the mother into her urine. Thus once more the maternal blood acts as a go-between, and the urea and useless salts and fluid from the fœtus are passed into the blood of the mother and out again by her kidneys in her urine.

By referring to the description of the capillary circulation in the Introduction, p. 11, it will be clear that all that was said there holds good for the capillary circula-

tion in the placental villi. It is the essential feature of the placenta, the part where its whole function is carried out. The one difference is that the capillary network of the placenta performs in one structure the functions of respiration, absorption, and excretion which in the body are divided among the capillaries of the lungs, intestines, and kidneys. The blood returned from the placenta to the fœtus is distributed to the fœtal capillaries all over its body and there gives up its oxygen and nutritive material for building up the body tissues and returns to the placenta to get rid of the waste products. The fœtus thus lives as a true parasite on the mother, obtaining all the requirements for its life and growth from her blood.

From about the seventh month the placenta, having reached its full development, begins to show signs of degeneration or overripeness. White patches, known as *infarcts*, may be seen in the placenta at term if carefully examined. Some large enough to be conspicuous on casual inspection occur in nearly two-thirds of full-time placentæ. They are caused by blocking of the circulation to that area and the conversion of the patch into fibrous tissue. Sometimes red infarcts of a pinkish colour are seen, and calcareous deposits giving a gritty feel to the placenta, or forming a plaque of lime salts, are not infrequent. Cysts and tumours are occasionally found. Unless a large area of the placenta is affected, none of these conditions appear to influence the fœtus. The placenta in syphilis used to be described as large, œdematous, and soft, but this view is doubted by many. Large size of the placenta and red infarcts are said to be found with albuminuria, syphilis, antepartum hæmorrhage, and other abnormal conditions.

The *umbilical cord* or *funis* is the medium of communication between the fœtus and placenta. At term its length is usually about the same as that of the fœtus, from 18 inches to 2 feet, but may vary greatly, and be very much longer or shorter. It has three blood vessels, contained in a mass of softish gelatinous tissue, known as " Wharton's jelly," and is covered externally by a layer of amnion. The three vessels are the two umbilical arteries conveying the blood to the placenta, and one umbilical vein conveying it back to the fœtus. The arteries are twisted round the vein in a corkscrew-like fashion, thus giving the twisted appearance to the cord as seen at birth. If the end at the child's navel is examined, it will be noticed that the covering of amnion becomes continuous with the skin of the abdomen, while the vessels pass into the interior of abdominal cavity through the navel. The placental end has already been studied, but it may be worth while to note that though as a rule the vessels do not break up till they reach the surface of the placenta, they occasionally do so when the cord is not attached to placenta directly, and reach it by spreading out fanwise through the membranes. This condition is known as *placenta velamentosa*. Sometimes, too, the cord instead of being attached to the centre of the placenta, is attached to its border like the handle of a racquet, forming what is known as a *battledore* placenta. Occasionally the placenta may be divided into two (bipartite) or very rarely into three lobes (tripartite), the cord dividing at the point of contact to supply each lobe.

Sometimes knots or kinks are produced in the cord by the fœtus, when small, passing through a loop, or twisting it, and if these are tight enough to interfere with the blood circulation they invariably lead to the death of the fœtus. Sometimes, too, a fœtal limb becomes so nipped by a coil of the cord, that it withers up, thus producing what is known as intra-uterine amputation of the part. A very long cord is more liable to form coils and knots during pregnancy and to prolapse during labour. A very short cord may be a factor in the production of malpresentation, may delay descent of the child in labour, or cause hæmorrhage, from premature detachment of the placenta, or even inversion of the uterus. Occasionally a short cord has been torn across in labour.

The *liquor amnii* is the fluid contained in the amniotic sac in which the fœtus floats. It is a clear, slightly saline fluid. At term it is sometimes slightly turbid, from the skin scales and fatty matter from the surface of the fœtus. In the mid-term of pregnancy the amount is relatively large to the size of the fœtus, but afterwards the growth of the child is much more rapid and by the end of pregnancy the amount of fluid is proportionately less. Generally at term there is about 1 to 2 pints, but it varies greatly ; sometimes it is abnormally increased, and when over

2 quarts or so the condition is known as *hydramnios*. The opposite condition of deficiency of liquor amnii is much rarer. It may result in compression of the fœtus, adhesion between the fœtus and amnion, and delay in the first stage of labour owing to lack of a proper dilating bag of membranes. Malformations and malpresentations are common.

During pregnancy the liquor amnii acts as a waterbed for the fœtus, protecting it from blows and jars, as well as diminishing the effects of the fœtal movements on the mother. During labour, as will be seen during the study of the physiology of its first and second stages, it has even more important functions in helping to dilate the soft parts, and in protecting the child and maternal parts during the uterine contractions, and, after rupture of the membranes, in flushing the passages.

The Fœtus.—As has already been stated, the growth of the ovum in the early weeks of pregnancy is mainly taken up with the formation of the chorionic villi—the roots for obtaining the material from the mother's circulation for the development of the fœtus. Hence the embryo is little more than 1 inch in length by the end of the second month, but after that its growth is rapid and the fœtus at full term is about 20 inches in length. A rough method of remembering the size of the fœtus at various periods after mid-term is that its length in inches is about half the number of weeks or twice the number of lunar months the pregnancy has advanced. Thus, at mid-term, the twentieth week (fifth month), it is about 10 inches in length, by the twenty-eighth week (seventh month) it is about 14 inches, and at term (fortieth week or tenth lunar month) it is about 20 inches. As the length of the child is a more accurate indication of its maturity than its weight, it is as well to have these numbers in mind when a question as to prematurity arises. The weight of the full-time infant varies greatly, from 5 to 10 or even 12 lb., but the average is somewhere about 7 lb. Below 5 lb. the infant is probably premature, *i.e.* born before its full time in the uterus is completed, or is badly nourished and feeble and less likely to survive ; above 10 lb. it is probably postmature, *i.e.* has been carried beyond the normal term in the womb. Boys are generally said to be slightly heavier than girls.

In early fœtal life the liver is disproportionately large, and even at full time is proportionately larger than in the adult. The meconium in the infant's bowels at birth is largely made up of dried-up bile and biliary products. There is also generally a little urine in the bladder, and it is not unusual to see the infant pass water immediately after birth, but the kidneys do not perform their functions fully until the placental connection is cut off, as the real excretion of urea is done through the chorionic villi. The skin glands also become active before birth, and the greasy vernix caseosa which covers the infant at birth is mainly made up of their secretions. (See also Chap. XXXI.—The Physiology of the Infant.)

From the midwife's point of view the chief thing about the fœtal anatomy is that of the head, as she ought to know how it adapts itself and fits itself to the various curves and diameters of the maternal pelvis. As this is of especial importance in understanding the mechanism of labour, it will best be considered with the mechanism of head presentations (Chap. X.).

CHAPTER V.

THE PHYSIOLOGY OF PREGNANCY.

The effects of pregnancy on the mother are best considered under the two headings of (1) the changes in the reproductive system, and (2) those in the general bodily functions.

(1) Reproductive System.

The most important changes are concerned with the growth of the uterus itself. During the first three months the increase is slow; the organ loses its pear shape and becomes nearly globular, owing to the increase being mainly in the transverse and antero-posterior diameters rather than in the vertical. By the end of the third month it has become too large to find room in the true pelvis, and so begins to rise up into the abdomen. Early in the fourth month it can plainly be felt above the symphysis as a rounded swelling, and by four and a half months it has pushed the coils of small intestine, which usually lie above it, further up into the abdomen and come to lie in contact with the anterior abdominal wall. By the fifth month the fundus is nearly up to the level of the umbilicus, and by the sixth month it is just above it; it is generally said to be at the level of the umbilicus at the twenty-fourth week. By the seventh month it is nearly half-way between the umbilicus and the lower border of the sternum (the breast-bone); during the eighth and ninth months it continues to rise till the top of the fundus is just below the sternum, but in the last few days of pregnancy it may sink down a little ("lightening"). These somewhat rough estimates of the size of the uterus at the different stages ought to be remembered by the student, as they are sometimes important in affording a guide to the time at which labour may be expected when the patient has no proper data of her own. As long as the uterus remains in the pelvis, it is quite evident that no enlargement of the abdomen will be noticeable, and that till the patient is four or five months pregnant it will be slight; after that the increase is rapid. As the uterus ascends in the abdomen it pushes the intestines upwards, so that it lies close against the abdominal wall,

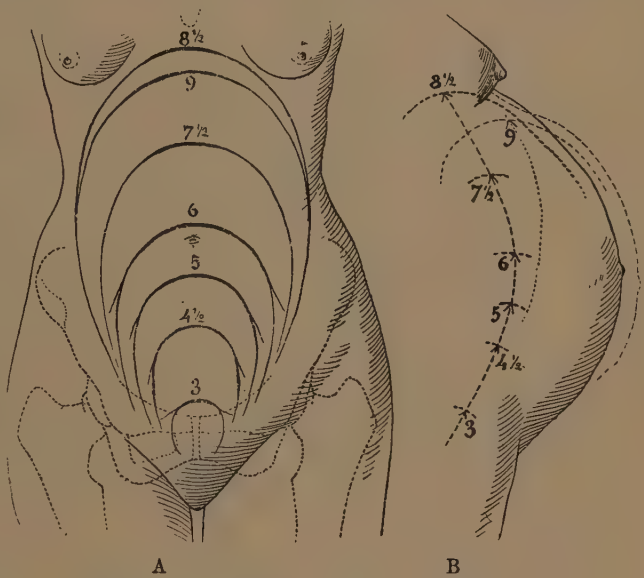

Fig. 44.—Height of Uterus during Pregnancy.

A. shows the approximate height of the fundus from the third to the ninth calendar month as felt by palpation.

B. shows the approximate height of the fundus as seen from the side. It shows the change in the shape of the abdomen when the fundus falls forward in the last week or so.

which supports it when the patient is in the erect position. The intestines, then, are above, behind, and to the sides of the growing uterus. Another point is that it does not grow straight up but deviates to one side, nearly always the right, so that the fundus points towards the ribs on the right side. At the same time it rotates on itself also towards the right, thus bringing the left ovary towards the front and middle of the abdomen and the right towards the back. During pregnancy some softening of the sacro-iliac joints takes place and allows of a slight amount of movement. Thus, when the woman is walking about, the sacral promontory swings back a little, and so increases the conjugate at the brim. By placing the woman in the Walcher position (p. 309) the extreme limit of this movement can be utilized to facilitate the passage of the head through the brim. When she lies down and flexes her thighs, the promontory comes forward and the lower end of sacrum goes back, thus increasing the antero-posterior diameter at the outlet.

The length of the uterine cavity increases from 2½ inches in the non-pregnant state to nearly 14 inches at term, and its breadth to about 9 inches; the weight from under 2 oz. to over 2 lb. The enlargement is due not only to the distension of the uterus by the growing fœtus, liquor amnii, and placenta, but also to the markedly increased size of the individual muscle fibres that form its wall. They are lengthened tenfold and thickened fivefold. There is also a slight increase in the number of muscle fibres and considerable increase of vessels and connective tissue. The cellular tissue round the uterus is also increased. The cervix shows little change as compared with the body, but partakes in the general softening of the tissues.

(2) The Body as a Whole.

Owing to the increased weight of the uterus and its contents, the organs and structures in the pelvis and lower part of the body show certain changes; the veins in the whole of the lower part of the body become distended and sometimes varicose. They are usually seen most readily in the legs, but are also frequent in the labia and about the lower end of the rectum, where they form the painful swellings known as *Piles* or *Hæmorrhoids*. "Dangerous varicose veins" is one of the conditions specially mentioned in the rules of the C.M.B. in which the midwife must advise her patient to seek medical advice. The swelling of the feet and legs which frequently accompanies the venous enlargement is only another indication of the obstruction to the circulation by the uterus. The pressure of the pregnant uterus on the nerves may also cause pains and cramps in the legs, and pressure on the bladder may give rise to an inability to hold the water for long, and it is possible that it may be the cause of the constipation which frequently troubles pregnant women, possibly by affecting the nervous mechanism governing the muscular movements of the bowels (peristalsis, p. 15). The breasts become larger and fuller, owing to the increased blood supply, and the nipple becomes more prominent; the breast changes are of help in detecting the pregnant state.

Marked pigmentary changes occur in the skin, especially in dark-complexioned women, for instance the linea nigra (p. 72) in the abdominal wall, and sometimes dark patches occur on the forehead and face. The nervous system is sometimes disturbed, causing neuralgia, sleeplessness, change in temperament and mental outlook, perversions of appetite (longings); the digestive system may be in an irritable condition, as shown by the nausea and sickness so frequent in the early months, and breathing may be embarrassed by the enlarged uterus causing interference with the movements of the diaphragm.

Building up and breaking down of material (metabolism) is bound to be increased by the growth of the uterus and breasts described above, and of the fœtus and placenta. This increased metabolic activity is accompanied by retention of nitrogen (cp. Introduction, p. 15) by the mother, as shown by a diminished output of urea. It would appear that the amount of nitrogen retained is more than would be represented by the growth of the uterus, breasts, and fœtus, and the suggestion is made that it is a reserve stored up for lactation. It is inadvisable, however, to tax the maternal powers of metabolism and excretion by a diet rich in nitrogenous

(*i.e.* protein) material. There would seem also to be an increased demand for carbohydrates, which can be satisfied with less hesitation, as they are stored both in the placenta and fœtal liver, and are used up by the fœtal tissues for their growth. This need for carbohydrates is shown by the pregnant woman readily falling into the condition induced by carbohydrate starvation and known as acidosis. There is also an increased retention by the mother of lime and phosphates.

CHAPTER VI.

THE DIAGNOSIS OF PREGNANCY.

It is necessary for the midwife to know the signs of pregnancy, because occasionally she may be called to patients who consider themselves pregnant or even in labour, and are mistaken; also she may have to advise a patient to seek medical advice because of some abdominal swelling which does not present the usual characteristics of the pregnant uterus. The diagnosis of pregnancy in the early months depends on discovering changes in the size and shape of the uterus that can only be appreciated by one accustomed to examining that organ in the non-pregnant condition and therefore falls to the medical practitioner. It is chiefly the recognition of pregnancy in the later months that concerns the midwife. As it is important that the pupil should from the first acquire a systematic method of investigating cases, this subject will be best treated in the order in which the actual investigation should be made. If the patient was present, the first thing would be to ask her certain questions, to find out if she had the *symptoms* associated with pregnancy.

Symptoms or Evidence obtained by Questioning the Patient.—The first question would naturally be as to the menstrual periods. The cessation of menstruation is the symptom by which women judge whether they are pregnant and from which they calculate the probable date of their confinement. It is an invariable accompaniment of pregnancy, and when the periods cease suddenly after having been quite regular in a healthy woman in the childbearing period of life, the presumption is that pregnancy has occurred. There are, however, certain sources of error, and amenorrhœa by itself is not sufficient. There are cases in which patients have menstruated for the first two or even three months of pregnancy, and occasionally patients will be met with who state that they have menstruated throughout their pregnancy. It is not impossible for menstruation to occur during the first three months, as the ovum does not occupy the whole cavity of the uterus till the end of the third month; that is to say, it is possible for some bleeding to occur from the lining of the uterus before the ovum has filled up the cavity completely. It is, however, extremely rare for it to occur for at any rate more than one month, though the possibility must not be lost sight of. Occasionally patients are in doubt from which month to count their pregnancy, because their last period was a very slight one—perhaps only one day instead of four or five—and it may turn out that the pregnancy ought really to be counted from the last period of normal duration, *i.e.* the one before. In these cases a slight menstrual loss has occurred from the unoccupied decidual surface. After the third month there is no such decidual surface, and therefore any hæmorrhage from the uterus must be due to some separation of the ovum from its attachments, and will be unlikely to occur at regular intervals. But women who keep no account of dates, and who describe any vaginal loss as a "period," may lead the midwife astray unless she is careful to find out the nature of the loss, and whether it occurred at the expected time, and whether it was exactly like a normal period in amount and duration. Further reference will be made to these erratic hæmorrhages under abortion and antepartum bleeding.

On the other hand, the periods may cease from other reasons than pregnancy, from ill-health, as in anæmia, or constitutional disease, as tuberculosis, or hysteria, or from atrophy or wasting of the genital organs, such as occurs at the change of life, but may come on long before the usual age. In such cases, however, there is generally some preceding irregularity, and it is usual for the cessation to be more gradual than the sudden stoppage following conception.

Also it must not be forgotten that pregnancy may occur during the amenorrhœa of lactation or ill-health, so that this symptom may not be available for diagnosis.

The point is that in doubtful and difficult cases the evidence in regard to menstruation must be weighed for each individual patient. In those in whom menstruation is regular to the day, a week after the proper time will raise the suspicion of pregnancy, whereas in those habitually irregular and still more in those who have at times missed several periods without obvious reason, it may be impossible to argue much from some months of amenorrhœa. Again, patients may be uncertain or unreliable as to their dates or may have some object in concealing their condition and make false statements. Also though it may be taken as a working rule that without amenorrhœa pregnancy may be excluded, great care must be taken in cases in which " periods " are said to be present to discover the character duration, and periodicity of the loss, if there are other symptoms or signs suggestive of pregnancy.

Morning sickness or nausea is sufficiently often present as to demand inquiry to some degree during the earlier months. It is generally said to begin about the time of the first missed period and to last for a couple of months or so, but it varies greatly in duration and severity and is by no means constant. It is generally most marked in first pregnancies. It may be only a slight nausea on rising in the morning or there may be actual vomiting, and not limited to the morning but continuing throughout the day. It is not infrequently accompanied by an excessive secretion of saliva. The general health is rarely affected. When the vomiting is more than occasional, when it lasts beyond the fourth month or begins in the later months, and, in any case before the general health is affected, the midwife must insist on medical advice being obtained. Its absence is not of any weight in excluding pregnancy, and it may be due to other causes, dyspepsia, chronic alcoholism, or cirrhosis of liver. Hence as evidence of pregnancy it is only of value in conjunction with other symptoms.

Frequency of micturition (passing of water) is not uncommonly complained of during the second and third months, owing to the pressure of the enlarged uterus on the bladder. It disappears as the uterus rises up into the abdomen.

Tenderness and fullness of the breasts, and, later, their enlargement, may have been noticed by the patient. The swelling of the abdomen is not usually evident to the patient till the uterus has reached the umbilicus, *i.e.* till after the mid-term.

Quickening, or the feeling of the movements of the fœtus by the mother, commonly occurs about the time when the uterus comes up against the abdominal wall, *i.e.* about 4½ months, and is useful evidence of pregnancy in those patients who have been pregnant before and recognize the sensation. It is usually described as a " fluttering." In some patients " quickening " gives rise to sickness or faintness, but in others the movements may begin so gradually as not to be noticed for some time. On the other hand, women are often misled by movements or other abdominal disturbance into thinking they are pregnant, and such false impressions are a marked feature of the phantom pregnancy (pseudocyesis). Occasionally women have indefinite sensations which they cannot describe and which lead them to think they are pregnant, and in women who have been affected in this way in previous pregnancies such feelings on their part may be taken into consideration.

Signs of Pregnancy.—When all possible evidence has been obtained by questioning the patient, the attendant must now examine for the *signs* of pregnancy and in a systematic manner. The examination of the breasts should be carried out first, then the abdominal and finally the vaginal examination. In each of these the eyes should be used first for *inspection*, the fingers next for *palpation*, and lastly, when of use, the ear for *auscultation*.

Breasts.—The signs here are only of value in the first pregnancies, as the breast never goes back to its original form. In multiparæ the breast signs are often deceptive and little reliance can be placed on them. The breast signs as found in a primigravida (a woman pregnant for the first time) will therefore be described.

The breasts become larger, with prominent veins on the skin giving it a marbled appearance ; they become more prominent or sag downwards from their increased

weight. Sometimes fresh skin cracks (striæ) are seen, pinkish in colour, radiating from the nipple, and generally more marked on the upper surface. They are very useful evidence when present, as they indicate a rapid enlargement of the gland, which is extremely rare save as the result of pregnancy. They may be seen from the fourth month onwards, but are often not well marked till the later months. The changes in the nipple and areola (the pigmented area around) are extremely characteristic. The nipple becomes enlarged and more erect and covered with branny scales of dried secretion. The areola is slightly raised above the skin surface and darkened, the increase of pigment being more marked the darker the patient. In fair women it may scarcely be noticed, in dark women it becomes almost black and may be noticeable before the end of the second month. Hence in estimating the importance of this sign the complexion of the patient must be taken into account. Forming a circle round the nipple may be seen, from the fourth month onwards, a row, sometimes two, of whitish raised spots, Montgomery's follicles. They are enlarged skin glands which supply a little oily secretion to keep the nipple soft and supple. After the fifth month the secondary areola may be noticed. It gives an appearance as if the primary areola was spreading out on to the surrounding skin. It is of a dappled appearance, as if the colour had been washed out in spots, leaving dark areas round the light, and has been compared to "raindrops on a dusty pavement." It can readily be observed in any dark woman.

The fingers should now be used, and first to notice the hard knotty feel of the active breast. This is done by placing the flat of the hand on the breast and pressing it backwards against the chest wall. In this way the fingers are able to appreciate the nodular feel of the lobules of the active gland. Also by putting the fingers and thumbs of the two hands together round the nipple and pressing back towards the chest so as to make the nipple and areola bulge a little through the opening between the hands, the puffiness of the areola will be made more evident. The superficial muscles in the skin under the areola are also very sensitive and may be seen to contract on stroking, causing the areola to wrinkle up. An attempt should now be made to squeeze secretion from the nipple. The whole breast should be gently compressed between the fingers and thumbs of the two hands from its outer border towards the nipple. From the end of the second month a little clear serous fluid can generally be expressed, and in the later months yellowish colostrum is often noticed at the base of the drop. In women who have had children before, some secretion remains in the breasts, but is generally not so clear as the secretion of pregnancy, and occasionally fluid may be obtained from the breasts of women who are not, and never have been, pregnant.

Abdominal Examination.—From the fourth month onwards the enlarged uterus will be easily felt, and what we have to determine chiefly on abdominal examination is whether it gives the signs which will differentiate it from other tumours or swellings of the abdomen. The chief points on which we depend for recognizing the pregnancy tumour are that—(1) It should correspond in size with what we would expect from the period of pregnancy reached, *i.e.* from the number of periods missed; (2) it contracts on manipulation, becoming harder and more defined and then relaxing and becoming softer again; (3) it gives evidence of the presence of a fœtus floating in fluid, first of all by giving the sensation of a solid body bobbing about in fluid, then the fœtal parts may be felt and the movement of the fœtus recognized, and last of all, the beating of the fœtal heart may be heard.

The examination should be conducted as described for the patient in labour (p. 124).

First look carefully at the abdomen. Naturally, its appearance will vary with the stage the pregnancy has reached. A dark median line, running from the navel to the pubes, the linea nigra, if generally visible from about the end of the fourth month in all but very fair patients. It is most striking in gipsies and half-castes and very dark women, but, like the pigmentary changes in the breasts, is only of value in primigravidæ. In the last three or four months the striæ gravidarum or skin cracks will be plainly visible. When recent they are pink, the old ones are white like fine scars. Hence only fresh pink ones are of value, as the white ones may be due to previous pregnancies or to swelling of the abdomen from other causes,

because, besides pregnancy, tumours, dropsy, or even obesity will give rise to striæ in the abdominal wall. The enlarged uterus will not form a prominence in the abdomen till about 4½ months; after that it will be evident as a median swelling rising up from below and with a little deviation to the right, and generally with a smooth regular surface, though at the end of pregnancy knobs and prominences due to projecting parts of the fœtus may be seen. In the first half of pregnancy the navel may be sunk deeper than normal, late in the second half it may be flush with the surface or even project a little.

Having completed the inspection of the abdomen, the attendant will now proceed to palpation, and endeavour specially to discover whether there is a swelling to be felt in the abdomen and whether it presents the characteristics of the pregnancy tumour. First, she must bear in mind the height of the pregnant uterus at the various months, and if there is a history of amenorrhœa to guide her, her first object will be to satisfy herself that there is a tumour in the abdomen corresponding in size to the number of periods missed. If the patient has missed three or more menstrual periods the fundus ought to be felt on palpation, by five months it ought to be almost at the umbilicus, and so on, as already described (p. 67), until near term it will be somewhere under the ribs. As these measurements are approximate, only marked deviations from them would raise the suspicion that the case was not one of pregnancy. For instance, if with three months' amenorrhœa the tumour was above the umbilicus, or if with seven months' amenorrhœa the tumour was well below the umbilicus, the probability would be either that there was no pregnancy at all, or it was pregnancy complicated with an ovarian or uterine tumour, and in any case further advice should be obtained. Having discovered, however, that the tumour corresponds to about the size expected from the history, the next thing is to note its characteristics. Examine for the painless contractions of pregnancy which, though present throughout, are not readily appreciated till the uterus can be easily felt in the abdomen, *i.e.* from the fourth month onwards. Notice particularly any change in its consistence. At first it feels, and this is especially the case before any fœtal parts are recognizable, soft and elastic, and perhaps a little ill-defined. Then it becomes firmer, harder, and much more defined, and in a short time becomes soft and less defined again. Occasionally, when these hardenings are particularly well marked, the uterus during the contraction may be seen to become more evident and to stand out more plainly against the abdominal wall. This sign is not always easy to obtain so as to be unmistakable; but when it is certainly present it is most valuable, as there are scarcely any other tumours which show it. A uterus with fibroid tumours in it very rarely does so, and some bowel tumours may simulate it; but in the vast majority of cases the occurrence of unmistakable contractions means pregnancy. Next, endeavour must be made to demonstrate the presence of the fœtus within the pregnant uterus, and the methods of doing this will depend on the stage of pregnancy reached. It can rarely be demonstrated before the end of the fourth month, and often not till later than this.

The method of detecting the presence of the fœtus before the fœtal parts can be felt is known as *ballottement*. This is carried out in the following way. Whilst the uterus is steadied with one hand the finger-tips of the other make a succession of sudden taps over its whole surface. At some part or another the fingers will dip down on to a solid body which will appear to move away. The finger by these quick taps displaces the fluid and comes down firmly for the moment on to some part of the fœtus.

Another method of eliciting this sign is to place the patient on her side and to put the hand under the prominent abdomen and jerk the fingers upwards suddenly. In this way it is possible to feel the fœtus bob upwards and drop back on to the fingers again. External ballottement can be obtained during those months when the fœtus is small and the amount of liquor amnii relatively large, from about the fifth to the seventh month. After that the fœtus can be recognized by the next method.

By adopting the method of examination described on page 126, it is possible to distinguish the head, back, and small parts of the fœtus, and perhaps feel the movements of the child. When this is made out, and it is generally possible by the sixth

month, the diagnosis is made certain. With a little experience in abdominal palpation it is quite easy in the vast majority of cases to differentiate the parts of the child from the seventh month to full time.

After inspection and palpation comes *auscultation*, or listening for sounds coming from the uterus, and chiefly for the beating of the child's heart, which can usually be heard from the sixth month or even earlier. At first a stethoscope is required, but during the last two months it is sufficient to put the ear direct to the abdominal wall, or preferably with a towel between. The fœtal heart sounds are always compared to the tick-tack of a watch below a pillow. Near term it is quite easy to count the beats, and they are then about 120 to 140 to the minute. Earlier in pregnancy they are faster, fainter, and more difficult to count. If the back of the child can be located, they are best heard over it (p. 130) ; but when this is uncertain, the whole of the front of the uterus must be auscultated. Some practice is required to learn this sign, but if the pupil takes every opportunity when attending her cases at term she will be able to pick up the heart sounds in cases that are still some weeks short of full time.

As the fœtal heart sounds are the most conclusive sign of pregnancy, care must be taken to make certain that they are not confused with other sounds. As the mother's heart sounds may be transmitted from the aorta, the pulse at the mother's wrist should be compared with them, and sounds heard momentarily and then lost should be neglected. They should be heard continuously, and counted. The slower and the more plainly the heart is heard the larger the child, hence it is said when below 120 that the chances are in favour of its being a male.

Other sounds may be heard when listening for the fœtal heart. A loud blowing or whistling sound of the same rate as the mother's pulse is the *uterine souffle*, due to the blood rushing through the enlarged uterine vessels, and therefore best heard at the sides of the uterus, but often most distinctly on the left. Sudden knocks due to fœtal movements, and gurgling sounds due to the passage of fluid and gases through the maternal intestines, may also be heard.

In cases where there is any doubt as to the presence of the pregnant uterus or other tumour in the abdomen, percussion of the lower part of the abdomen ought to be practised. This may be done by flicking the abdomen with the fingers, or by placing the fingers of the left hand firmly on the abdomen and tapping them suddenly with the middle finger of the other hand. If a drummy, hollow note is given out, it suggests that intestine only and no tumour, pregnant uterus or otherwise, is present ; if the note is dull and not resonant, some solid or fluid swelling is present.

The last part of the examination for the diagnosis of pregnancy is the vaginal examination, and in many cases may not be required. Naturally, if the pregnancy is so far advanced that the fœtal parts and fœtal movements can be felt, and the fœtal heart-beat heard, the diagnosis is certain, and a vaginal examination is unnecessary. On the other hand, in the early months the doctor obtains the most important evidence by vaginal examination ; and in doubtful cases, before the positive signs can be found on abdominal examination, the vaginal examination gives great assistance. The points to be noticed by the midwife are : (1) On *inspection*, the presence of dilated or varicose veins about the vulva, increased vaginal secretion, and a blue coloration of the vaginal walls, all noticed from about the fourth month onwards. On holding open the labia and looking into the vagina its walls will be seen to be of a violet bluish colour instead of the usual pinkish hue. It might be compared to the difference between the normal red colour of the lips and the cyanosed colour of the lips in heart disease. It is due to venous congestion consequent on the pregnancy. (2) On *vaginal examination* the cervix will be felt high up and far back, and to be much softer than in the non-pregnant state. The non-pregnant cervix feels hard and almost cartilaginous—like the firm feel of the cartilage in the tip of the nose ; after the first two months of pregnancy it becomes markedly softened, so that it feels like the lip and no different from the vagina and surrounding structures. Internal ballottement can be practised by the finger in the vagina giving a sudden push into the anterior fornix, when the fœtus will be felt to bob away, and drop back on to the finger again. Internal ballottement can be obtained

earlier than external, but it is too difficult to be of use to the midwife, and, further, is inadvisable, as it may provoke miscarriage if not done very gently.

It will be clear from this account that the diagnosis of pregnancy, especially in the early months and in difficult cases, does not depend on any one symptom or sign but on the accumulation of many, and that all the evidence available must be collected and weighed if a correct opinion is to be formed. In any case in which there is uncertainty as to the diagnosis and there are no urgent reasons for an immediate decision, the best plan is to make repeated observations at intervals of two or three weeks to see if the rate of growth and other signs develop as would be the case with the pregnant uterus.

Throughout the chapter attention has been directed to the period of the pregnancy at which each sign or symptom may be found. This is important in practice, because it shows what may be expected at the stage of the pregnancy at which the examination is made. The pupil should make a table showing the symptoms and signs to be found at each month of pregnancy, as questions on the subject at the C.M.B. examination usually relate to the signs at some definite stage in the pregnancy.

CHAPTER VII.

HYGIENE, MANAGEMENT, AND SUPERVISION OF PREGNANCY.

Pregnancy is a natural condition, and many women pass through it without trouble or even discomfort, and not infrequently will say that at such times they never felt better. The fœtus during its development, however, throws an extra strain on all the organs of the body, especially on the organs of excretion and in women pregnant for the first time. The bowels, kidneys, and skin should therefore be kept active. In the later months the size and weight of the gravid uterus may cause discomfort and lead to fatigue on slight exertion ; shortness of breath, bearing down, backache, and aching in groins and legs may be caused in this way.

As a broad working rule it may be said that all that is necessary is that the woman should live under as healthy and hygienic conditions as her circumstances permit. The answer of a candidate at the C.M.B. examination that the pregnant woman should live " a godly, righteous, and sober life " puts the matter in a nutshell. Perhaps a further reminder that " cleanliness comes next to godliness " would have made it more complete. The following hints as to the advice to be given to the pregnant woman must clearly be modified to meet the social condition, education, and circumstances of the individual patient.

Mode of Life.—The ordinary household duties may be continued throughout pregnancy, but from the first care should be taken not to do heavy work or work entailing sudden or severe straining efforts. Patients should therefore be warned against lifting and carrying heavy weights, stretching up to hang washing or pictures or anything which may jar the body, as miscarriage may be provoked. For the same reason over-exertion and fatigue are to be avoided. Standing about increases the tendency to varicose veins and aching in the limbs much more than walking or active exercise, as muscular movement promotes the flow of blood to and from the limbs. Some women, especially towards the end of their pregnancy, are inclined to rest indoors and take insufficient exercise. Exercise in the open air is necessary both to keep the body in health and the muscles in training for the exertion of labour. Fresh air and sunshine are the best tonics in the world, and promote the throwing off of waste matter by the lungs and skin and improve the condition of the blood and general power of resistance (p. 27). The woman should, therefore, be encouraged to go out in the middle of the day and not wait till sundown for her airing, to take as much exercise as she can without tiring herself, and, when indoors, to keep her windows open, particularly at night. Close and stuffy rooms, theatres, or picture-houses, and late hours should be strictly limited.

Frequent, if possible daily, warm baths are useful for keeping the skin open and active ; if a bath is not possible the woman should be told to wash all over once a day. In the later weeks special attention should be paid to the washing of the vulva. There is increased secretion from the vulval glands which tends to collect in folds and crevices of the skin and thus form a breeding-ground for organisms and become a source of irritation. Care must be taken to wash the nipples and keep them free from crusts of dried secretion.

Dress.—Woollen underclothing is to be preferred, but in the early months it is unnecessary to make any special change in the clothing. From about mid-term, when the abdominal enlargement becomes marked, corsets should be loosened and all tight bands about the waist discarded. In the later months the corsets are best left off altogether, and the ideal plan would be to have skirts and petticoats suspended from the shoulders as so to get rid of any pressure on the waist, which might hamper the circulation or respiration and the action of the liver or kidneys. Any tightness

about the waist also tends to prevent the uterus developing upwards and to force it forwards and thus produce anteversion and pendulous belly (p. 125), as well as increasing the impediment to the free flow of blood from the lower part of the body. Garters, too, greatly aggravate any tendency to varicose veins, and should be prohibited. In multiparæ with a lax abdominal wall, in whom the uterus tends to sag forward, the support of an abdominal belt will be advantageous. It is the lower part of the abdominal wall which requires support.

Diet and Digestive System.—Pregnancy calls for some increase in diet, which should be plain and easily digestible. Red meat taxes the excretory organs and should therefore be restricted—one meat meal a day is sufficient. Rich and highly seasoned foods, pickles, vinegar, and relishes, such as are often "fancied" during pregnancy, should be barred. Porridge, whole meal bread, fruit, and vegetables are useful to stimulate intestinal action and counteract the tendency to constipation. Milk puddings, as representing a largely carbohydrate diet, and salads, uncooked tomato, apples and oranges are all valuable, the latter group for their vitamin-content. Plenty of fluid should be taken and the drinking of water—between meals so as not to interfere with digestion—should be encouraged; a glass of hot water sipped slowly first thing in the morning, and repeated at night if need be, keeps the bowels active and flushes the kidneys. Milk and cocoa are to be recommended; tea if freshly made and not strong is harmless, but all forms of alcohol should be forbidden as throwing needless strain on the kidneys.

It is essential that attention be given to the cleansing of the mouth, as all the food has to pass through it. It is particularly important that the teeth should be brushed before going to bed; if particles of food are left between the teeth they undergo fermentation and putrefaction and cause foul breath and a bad taste in the mouth. A dirty mouth and bad teeth are a cause of digestive trouble and may form a source of poisoning the system. Pregnant women often suffer from constipation and may seek advice on account of it. A regular daily action of the bowels is important as a means of diminishing the absorption of waste products from the bowel and the work thrown on the liver and kidneys. Such simple measures as modifying the diet so as to provide an active stimulus to the bowels, and the plentiful use of water, as already mentioned, should be tried in the first place. Fat in the shape of butter or dripping or olive oil may be added to the diet. If such measures do not suffice, a mild aperient must be used as needed, but strong purges are to be avoided as liable to provoke miscarriage. Paraffin, liquorice powder, or infusion of senna pods may be recommended. Castor oil is not good for habitual use.

If morning sickness is troublesome, a light breakfast should be taken in bed and the patient should lie down for a hour or till all feeling of nausea has passed. If sickness occurs with other meals and is not overcome by resting for half an hour before and after the meal, a medical practitioner should be consulted.

The **nervous system** is more irritable and readily excited during pregnancy, and therefore so far as possible the pregnant woman should be shielded from worry and anxiety and should avoid occasions and occupations likely to cause excitement.

It is especially important that she should sleep well, and anything which seems to interfere with sleep should be remedied or removed. Fresh air is the best soporific; a glass of hot milk at night is helpful. Cramp in the legs is sometimes a disturbing factor in the later months; the affected leg should be stretched out strongly, with the heel thrust out and the foot bent up towards the shin, and the affected muscles massaged. General massage is useful in bad cases of sleeplessness.

Nipples.—Care should be taken that the clothing is loose over the breasts and that there is no flattening of the nipples. If the nipples are retracted they should be drawn out and made pliable by some emollient ointment such as lanoline. This is better than hardening by washing with spirit and water, as often recommended. Spirit tends to make the skin of the nipple hard and brittle so that it cracks easily.

The question of sexual relations during pregnancy is one on which advice may be asked. As there is evidence to show that sexual intercourse in the last month of pregnancy increases the risk of puerperal infection, every effort should be made to explain the danger and the importance of restraint. From the hygienic point of view it would be better that coitus was not practised during any part of a preg-

nancy, but the effort to follow the counsel of perfection might lead to worse evils than it was intended to prevent. All advice in this regard must depend on the nature of the individual case.

Antenatal Care and Examination.

Antenatal supervision is one part of the effort to maintain health and avoid trouble during childbearing. The primary object in all medical work may be stated as the removal of the causes of disease and the preservation of health. In other words, the maintenance of normal function in all systems of the body—the digestive, the cardio-vascular, the nervous system, and so on. In midwifery the chief purpose is to secure natural function throughout reproduction, during pregnancy, labour, lying-in, and lactation, and the early developmental stages of the newborn infant, and success in its practice may be estimated by the proportion of normal cases attained. Once this point is appreciated, it will be clear that careful observation from the start of reproduction, *i.e.* pregnancy, is essential, if causes of disordered function are to be removed or disorder remedied as soon as evidence is obtained of its occurrence. The midwife must take a prominent place in this work, and it will therefore be well to consider what the supervision of the pregnant woman involves, and the part the midwife is called on to play in it.

The aims of antenatal care may be stated as :

(1) To maintain health of body and mind throughout pregnancy.

(2) To preserve the pregnancy to its full time.

(3) To foresee and avert preventable difficulties and complications in labour, and after.

(4) To secure the best provision for labour, prepare the mother for the nursing and care of her child and educate her in the care of her own health and that of her family.

The better the health of the mother throughout pregnancy, the greater will be her resistance to infection and her efficiency in bearing and rearing her child. A general medical overhaul as for life insurance is advisable early in all pregnancies. Elsewhere it has been stated that pregnancy, like severe physical exertion, puts a strain on all the systems of the body, and the earlier any weaknesses are discovered the easier it is to guard against breakdown and remedy trouble at its onset. This part falls to the medical practitioner, but, when possible, should be carried out with the midwife present, and the duty laid on the midwife of maintaining further observation on the patient and of seeing that medical instructions are carried out. She should be informed by the doctor of anything discovered in the patient that requires to be watched, so that she can report at once should fresh symptoms arise, and she ought to be capable of carrying out routine examination of the urine and other investigations, such as pelvic measurement and obstetrical diagnosis. The health of the mother is the first consideration throughout ; in the early months, preservation of the pregnancy is chiefly in view, because that is the time abortion is most common ; in the last two months, investigation is more particularly directed towards foreseeing and preventing difficulty and complication in labour. The avoidance of abortion and premature labour is entirely a matter of eliminating such provoking causes as are known, *e.g.* toxic states, local pelvic conditions, and any violent disturbance, whether by injury, wilful or accidental, or internal commotions, such as violent purging, intestinal upset or mental excitement. Some of these investigations must be carried out by a doctor, but the midwife can assist by giving advice as to avoidance of disturbing causes and generally regarding the hygiene of pregnancy.

The obstetrical examination to determine the presentation, position, the pelvic capacity and fit of the head into the brim, can be carried out by the midwife, though it should be checked by the doctor about the thirty-fourth to the thirty-sixth week. The methods are described on p. 123 and p. 202.

There are a number of other essential matters that fall almost entirely within the sphere of the midwife. The question of the arrangements most suitable for the labour will be decided by the practitioner who has seen her, and in the usual event

of labour being conducted at home it will fall to the midwife to see that adequate preparations are made for it and for the infant when born. The breasts and nipples (p. 77) will call for examination with a view to remedying possible failure to nurse. Instruction is necessary in hygiene, and an effort should be made to arouse in the woman the mental attitude most likely to promote normal function (p. 84). The midwife must study each individual patient and her circumstances, and endeavour to get the best out of her, and increase her efficiency and capacity for the nurture of her family. The personal touch is essential to success in this work, and the midwife is often the best placed and best equipped to provide it. She must hear the woman's troubles and difficulties and do her best to relieve them, referring to the doctor those that may call for attention that she cannot give.

Rule E 1 of the C.M.B. states :

" When engaged to attend a labour the midwife must interview her patient at the earliest opportunity to inquire as to the course of the present and previous pregnancies, confinements, and puerperia, both as regards mother and child, and to advise as to personal and general arrangements for the confinement, and, with the consent of the patient, visit the house."

" Whenever illness or abnormality has occurred in the previous pregnancy, and whenever the previous pregnancy has ended in an abortion, a premature labour, or a stillbirth, the midwife, on being engaged to attend the patient in her next confinement, shall explain that the case is one in which skilled medical advice is required, and shall urge the patient to seek advice from her medical attendant, or at a hospital or other suitable institution."

" The midwife must keep notes of her antenatal visits in the form approved by the Central Midwives Board."

" In nearly all districts, health visitors and maternity and child welfare centres are provided for the assistance of mother and child. It is desirable that the midwife, when she ceases attendance, should advise the patient to avail herself of such help " (Note to Rule 12A in Section E).

So far as possible she should co-operate closely with the patient's doctor and any local organizations for care of mothers and infants in accordance with the C.M.B. instruction.

The home visiting must be done as soon as possible, and considerable tact and care may be required to avoid arousing feelings of intrusion. With a sympathetic understanding of the difficulties and frailties of those among whom she works, the midwife is of all visitors the least likely to arouse such feelings, and is in the best position to secure reliable evidence as to what help and supervision the mother requires during her pregnancy, and what provision should be made for the infant when born. Defects in the house and insanitary conditions will call for attention, and if adequate preparation and accommodation for the labour and lying-in is impossible, it would give a fairer chance to mother and child if arrangements were made for her confinement to take place in a lying-in hospital or infirmary. Where this is impossible special efforts must be made to improve the conditions and obtain assistance towards making the home better fitted for the conduct of the labour. The midwife may, for instance, be of great assistance in helping the woman to expend her slender funds to the best advantage in making her preparations for the confinement. Suitability for its purpose, ease of cleansing and durability, must always be preferred to show and appearance, and unfortunately often the latter are the cheaper and the more attractive. Frills and trimmings for the cot, or the banana-crate that is to serve as such, too lavish expenditure on bonnets and long clothes for the baby must be discouraged, as must the purchase of cheap inflammable flannelette for the warmer and more durable flannel.

The requirements for the lying-in room will be found on page 142. The various articles should be seen and checked, and the midwife should make certain that the washing accommodation is satisfactory, that a mackintosh or effective substitute is provided, and that the patient will have a clean petticoat, three night-gowns, four clean sheets, a roller towel for binder, three or four towels, two or three dozen diapers or pads, and generally make sure that the best possible use is made of what accommodation and properties the patient can afford.

The same course should be pursued in regard to preparation for the clothing and care of the infant. Three night-gowns, two or three long flannels, two or three long-sleeved knitted or woollen vests, two or three flannel binders, two or three dozen napkins or diapers, and three soft towels should be collected and kept together in the cot, basket, or box which is to be reserved as a cradle. This provision of some suitable cot for the infant is a point on which the midwife should insist. Overlaying is one of the causes of death in the early months of infant life, and for its prevention it is essential that the mother is not allowed to have the child to sleep in the bed with her. A banana-crate, orange-box, or a drawer from a chest of drawers will suffice when a proper cot is unobtainable. A hot-water bottle to warm the cot, for which in cases of necessity such substitute as a stoneware ginger beer bottle may be used, and blankets and mattress for it must be ready. During very cold weather in homes in which it is impossible to keep the room or cot warm enough for the infant, some judgment must be exercised as to a relaxation of this rule against the infant sleeping with the mother. Unfortunately it is with the very small infants most in need of warmth that the danger of overlaying is greatest. On the other hand, if the cot cannot be kept warm, such small infants cannot survive, and therefore the risk of overlaying is more than counterbalanced by the warmth of being in bed with the mother.

Safety-pins, needle, reel and cotton, starch powder, vaseline, washing flannel, and a cake of toilet soap should also be set aside for the infant (p. 261).

Antenatal Care.—*Preliminary Investigation.*—At the time of booking, or as soon after as possible, a careful investigation must be made into the previous health and pregnancies, if any, and the present state of each patient. Many of the points considered will be found elsewhere, under the examination of a case of labour (p. 123) in the chapters on the complications of pregnancy and labour and in the note-taking scheme in the Appendix, but will require repetition here in order to collect them under the one heading and make the antenatal examination complete.

The inquiries as to the previous health should aim at discovering whether the woman has ever had any serious illness or operation, or been treated by a doctor, or at a hospital for any length of time, and if she has always been strong and healthy, or weak and ailing. Some illnesses are of more importance than others, because they may result in permanent damage which may seriously complicate pregnancy and labour. Rheumatic fever and chorea (St. Vitus's dance) in childhood or girlhood may be the cause of disease of the valves of the heart; scarlet fever may result in chronic kidney disease; tuberculosis affecting any part of the body, lungs (consumption), peritoneum (consumption of the bowels), the spine (spinal disease), joints (*e.g.* hip disease), bones, glands (especially common in the neck), may be wakened up into fresh activity by pregnancy even after long quiescence. A chronic winter cough, attacks of bronchitis or asthma, may give rise to shortness of breath and cyanosis. A history of fits or other nervous disturbance or of a mental trouble will suggest the need of supervision; infantile illness with late walking and teething may provide evidence of rickets in childhood; an operation for rupture or abdominal operation of any kind may leave a scar or weak spot in the abdominal wall and give rise to complications during pregnancy and labour.

History of Past Pregnancies.—If the patient has been pregnant before, the details of her previous pregnancies must be carefully inquired into. Their number, and what happened in each; how many proceeded to full time, and how many ended in abortion or premature labour. Histories of repeated abortion are very important and should at once suggest to the midwife the reference of a patient to a doctor or hospital or maternity centre; syphilis is a frequent cause, and the patient's blood should, therefore, be examined for this poison so that the proper treatment may be added if it is found. Abortion occurring habitually about the third month suggests displacement of the uterus or some chronic pelvic inflammation. Premature labours, dead-born or macerated fœtuses occur with syphilis, kidney disease, and various chronic intoxications will call for careful and prolonged medical investigation and treatment, so, in accordance with the second paragraph of Rule E, quoted above, medical aid will be sought. A story of excessive sickness, dropsical swelling, fits,

hæmorrhages, or other complications in previous pregnancies will naturally call for special watchfulness for fear of their recurrence.

The labours must also be investigated carefully, as the obstetric history of the patient is a most important guide as to what may be expected in the future. A long labour with instrumental delivery under an anæsthetic, a stillborn or injured child would at once indicate the possibility of some pelvic deformity and the necessity of the case being under medical observation. Other inquiries should be made for tearing or stitches being put in, hæmorrhage, or complications with the after-birth, fits and the occurrence of cross-birth or other malpresentation, as helping to show the need for special investigation and care. The lying-in times should be followed up to know how long the patient kept her bed, what sort of recovery she made, and if there were any complications requiring medical attendance. Frequent visits by the doctor, the taking of the temperature two or three times a day, foul or persistent discharge, douching, or operation under chloroform for removal of something left behind suggest infection, with the possibility of chronic pelvic inflammation. Any information available as to the weight or size of the children at birth, their vitality and progress, whether breast- or bottle-fed, how many survive and the age at, and cause of, death in any that have died, is valuable as affording hints both for the care of the mother and infant. Should she have been unable to suckle her child or only able to do so for a short time, it may be possible by special attention to her health to increase the supply of breast-milk or prevent failure to continue nursing ; should the children have been strong born and healthy and in the course of a month or two developed the signs of congenital syphilis (p. 329), or have died from diarrhœa and vomiting, or wasting, a clear line as to what will be required in the present pregnancy, or in the post-natal management, is indicated. Definite instructions on the preceding points are given in the C.M.B. Rule already quoted (E 1 ; C.M.B. for Scotland, E 1 (*a*) and (*b*)).

History of Present Pregnancy.—The date of the last menstrual period, and of quickening, if noticed, should be recorded, and information sought for in regard to any of the minor troubles, disorders, and more serious complications of pregnancy as described in Chapter VIII.

Examination and Observation.—While pursuing her investigations the midwife should make a close study of her patient, watching more particularly for those points which may throw light on her general condition and state of health.

She will note whether the woman's aspect is one of robust health or shows signs of ill-health. Her colour will be noted—if pasty or anæmic, or cyanosed ; if she is short of breath or has frequent coughing attacks, is tremulous or nervous in any way ; if she is thin, worn, and apparently badly nourished or of a heavy gross build ; if she is of a nervous, excitable temperament or placid and easy-going. The short stumpy woman requires special investigation to make sure that the pelvic measurements are normal, and therefore this type should at once attract attention. Her height should be measured and evidence of rickets sought for (p. 202).

Bearing in mind that one object of her examination is to discover those cases which require medical advice, the midwife's procedure will vary according to the parity of her patient and the stage of pregnancy reached. Special precautions are required in the case of primigravidæ, because there is no history of previous labours as a guide and because albuminuria and other manifestations of the toxæmia of pregnancy are much more common with them than in multiparæ. That the pelvis has allowed of the easy passage of a full-sized child is better proof of its capacity than all the measurements in the world, and therefore multiparæ who have had good times at their labours are known to have a roomy pelvis and require no pelvimetry ; on the other hand, the state of the abdominal wall should be examined and any tendency to pendulous belly noted, as this may be a cause of malpresentation. If there is a history of difficult labours that in itself indicates the need for medical advice. Should the woman report herself in the first three months of her pregnancy, no investigation of the pregnancy itself is possible, and the position and presentation of the child cannot be made out with any degree of accuracy till the last month or two. The chief duty of the midwife when the woman notifies her pregnancy in the early months is to satisfy herself that there is nothing in the patient's health

that requires medical supervision, to test the urine, to advise as to the management of the pregnancy, and warn her as to the symptoms which require attention (see Chap. VIII). The importance of obtaining advice for any loss of blood, however slight, as indicating a threatened miscarriage (see Chap. XX.), should be particularly impressed on her, and instructions given as to the dangers of neglect of it. Allowing for the differences in the examination of patients in these respects, the procedure would be somewhat as follows :

As regards the Pregnancy.—The breasts and nipples should be examined and advice given as to their care (p. 70). The abdomen should next be examined. The appearance on standing is of value in detecting pendulous belly (p. 125). Inspection of the abdomen with the patient lying on her back should be directed to noticing any unusual appearance of skin and abdominal wall—œdema of the lower part, large veins, rupture at the umbilicus or elsewhere, and of the abdominal swelling. The size of the tumour should be estimated and checked by the date of the last period ; undue size of the abdomen may indicate vesicular mole (p. 92) in the early months, hydramnios (p. 87) from mid-term onwards, twin pregnancy (p. 186) in the later months, or the presence of fluid or an abdominal tumour at any period of the pregnancy. If the abdomen is much smaller than would be expected for the period of gestation reached, carneous mole (p. 90) or death of the fœtus would be suggested. Palpation of the tumour for the signs to be found in accordance with the stage of the pregnancy reached (p. 73) would help to decide if everything was normal, and in the later months—from the seventh onwards—a careful investigation should be made of the presentation and position of the fœtus (see Chap. XI.), and in primigravidæ to see that the head was not detained above the brim (p. 202). Towards the end of pregnancy the rate of the fœtal heart-sounds and the position where they are best heard should be noted. The external pelvic measurements should be taken with a pelvimeter in primigravidæ and the diagonal conjugate measured, if the promontory can be reached (p. 203). In any case in which the measurements, the high position of the head, or the finding of a malpresentation give any indication of pelvic contraction, care must be taken to see that the patient has medical advice before the end of the seventh month at the latest.

If there is any complaint of swelling, discharge, or irritation about the vulva an inspection should be made for œdema, varicose veins, ulceration, and anything abnormal discovered reported to the medical adviser. The opportunity may also be taken to see if there are any piles (hæmorrhoids) protruding at the anus, and if they are inflamed or painful. If there is little to be seen with the patient lying down, she should be asked to cough or strain to determine whether there is any prolapse, or, better still, the vulva should be examined with the patient standing up and any protrusion through the vulval aperture noted. Sometimes in carrying out this part of the examination an escape of urine or coughing may be noticed (p. 87), and, if so, medical advice should be sought.

General Examination.—Reference has already been made to the importance of the midwife being constantly on the watch to note any signs of illness in the patient, especially in regard to anæmia, cyanosis, puffiness of the face, and shortness of breath. A yellow tinge of the skin, more particularly if the whites of the eyes are also yellow, indicating jaundice, is a serious complication of pregnancy (p. 224) urgently calling for medical treatment. A rare disease which is usually aggravated during pregnancy may attract the midwife's attention by her noticing a swelling on the neck just below Adam's apple (a goitre) and protruding, staring eyes. This disease (exophthalmic goitre) is accompanied by a rapid pulse and sometimes by trembling of the hands, and requires continued watching and treatment. The pulse should always be taken ; if its rate is rapid (100 or over) or if it is irregular either in time or strength, *i.e.* some beats coming quickly together and some slower or some strong full beats and some feeble small beats, or beats are dropped, there is probably something amiss with the circulation and possibly with the heart. Palpitation and shortness of breath on slight exertion are generally present in such cases. The blood pressure should be taken in all pregnant women at some time during the pregnancy, and repeatedly if the symptoms mentioned above are present or if there

is albuminuria or œdema, and the advisability of its being done is a reason for at least one general medical investigation.

The tongue, mouth, and throat should be inspected; a dirty tongue, decayed teeth with offensive breath may be noticed, and, especially when accompanied with indigestion and constipation, will require attention. Besides toothache, neuralgia and headache may be caused by bad teeth. Bad teeth and decayed stumps are a constant source of poisoning by infecting all food as it passes through the mouth, and yet it is often difficult to persuade women of the importance of dental treatment during pregnancy, a time when all intoxications mean increased risk and disability. Naturally it would be better that the patient's mouth should be cleared of decaying teeth before the occurrence of pregnancy, but should this not have been done, she runs less risk by undergoing dental treatment during her pregnancy than continuing with a dirty mouth throughout the pregnancy. Her condition is often urged by the patient as an excuse to postpone the disagreeable, but, nowadays, all authorities agree that pregnancy is no justification for postponing necessary treatment, and most antenatal clinics have a dental clinic attached or arrangements for the dental treatment of their patients.

The urine should always be examined by the midwife, as the presence of albumin is the most constant and usually the earliest indication of the toxæmia of pregnancy (p. 224) and of damage to the kidneys. A specimen of the urine should be obtained, care being taken that it is free from contamination with vaginal discharge; its appearance should be noted—whether free from offensive odour, cloudiness, deposit of pus (p. 248), and especially that there is no smokiness such as is produced by mixture with blood; sufficient urine should be poured into a test-tube to fill rather more than half of the tube, and tested by boiling, as described on p. 19: if any cloudiness appears, a drop of acetic acid (or vinegar) should be added to make sure that it is not due to phosphates, which come down with heat but are dissolved again by acid. If the turbidity remains it is due to the coagulation of albumin in the urine. A specimen of the urine should be examined fortnightly, and in first pregnancies weekly, during the second half of pregnancy. The feet and legs should be inspected for varicose veins and œdema. The pressure of the pregnant uterus tends to produce some obstruction to the return of blood from the lower limbs to the body, and hence both these conditions may be purely mechanical, and will be aggravated by undue size of the uterus, as by twins or hydramnios, or other increase in the pressure-effect, as a tumour in the pelvis. Heart failure will also produce both, but more especially œdema; with albuminuria the œdema is greatly increased and also found elsewhere than in the lower extremities—puffiness of face and hands, swelling of vulva and lower abdominal wall. Skin rashes, boils or ulcers; tremulousness, jerking movements of the nature of St. Vitus's dance, the first signs of which are often shown by the patient dropping spoons or cups; depression of mind, strange ideas or delusions, great anxiety and apprehension as to the future, especially if accompanied by sleeplessness and loss of appetite, would suggest the need of medical observation and treatment.

Digestive Disturbances.—Heartburn, sour eructations, and slight indigestion call for attention to the teeth and diet. Food should be taken slowly and well chewed. A pinch of bicarbonate of soda (baking soda)—as much as will lie on a florin—in a tablespoonful of water before meals will often prevent heartburn, or a teaspoonful in a wineglassful of water relieve it when present. The treatment of morning-sickness and constipation has already been mentioned; piles are aggravated by constipation and if inflamed cause much pain. If they come down after the bowels act, soft rags should be used instead of paper, and the patient should lie down for a time till they slip back, otherwise they readily inflame. Bathing with warm water and the application of zinc ointment may be advised. Patients with piles that come down when the bowels act should lie down, gently push back the prolapsed piles, and remain lying down for an hour or two. It is better in such cases if the bowels can be opened just before going to bed, as it lessens the risk of the piles remaining down and becoming inflamed.

Disorders of the Blood and Circulation.—The pale, sallow-complexioned woman is usually in need of fresh air, and if a holiday at the seaside or in the country can

be arranged for, that is by far the best treatment. If she is enabled to go without anxiety as to her family and household, the relief from domestic cares will work wonders. She must be urged to be out of doors and get all the fresh air and sunshine she can. Varicose veins of the legs can be considerably relieved by bandaging. A roller-bandage, preferably of crepe or some light elastic material, should be applied firmly from the ankle upwards before the patient gets up in the morning. Two pairs of bandages—one for use while the other is being washed—will be required. The woman should be instructed how to apply them, also how to apply pressure to the part should a vein rupture. The most essential thing with varicose veins, particularly if the vulva is also affected, is that the patient should avoid standing about and rest with the feet up as much as possible; when the home and children are to be looked after, the best has to be done in the circumstances.

Urinary Disturbances.—The importance of examining the urine has repeatedly been emphasized. The passage of small quantities of highly coloured urine is an indication for immediate examination, as it may denote a failure in excretion. The passage of large quantities of clear watery urine occurs in diabetes and chronic kidney disease; in the former case it is accompanied by great thirst, a big appetite, loss of flesh, and in advanced cases a sweet smell in the breath. Such symptoms show the condition to be very serious. Frequency in passing water is a common symptom in the early months and again just before labour starts. Should it be very troublesome and present day and night, it may be due to cystitis (p. 87). Smarting and scalding in passing water may be associated with irritation and inflammation of the vulva, and therefore investigation should be made for discharge and signs of redness and irritation about the meatus and external parts. Painful micturition and retention of the urine also call for medical advice.

Observation on the lines of this examination will be continued throughout the pregnancy in accordance with the needs of the individual case, and each patient will be given directions to report herself if she feels or notices that anything is wrong and encouraged to consult the midwife as to her health, the management of the pregnancy, and preparation for the confinement. If frequent examination has to be made in view of some suspected difficulty, every effort should be made to avoid alarming the patient. Often the excuse can be made of inspecting the preparations, or infant clothing, and the opportunity taken to make further investigation of the woman. In women of an apprehensive and nervous nature it may be advisable to concentrate on the baby and the preparation for it, in order to divert her mind from herself. Often the midwife will dispel a patient's apprehension of trouble, perhaps because she thinks she is too old to have a baby, or that too long interval has elapsed since the last, or because of some quite unreasonable dread on her part. So far as possible the aim should be to remove from her mind all suggestion of trouble, to inspire confidence in her own powers, in her ability to deliver herself and nurse and rear her child, and thus bring about the frame of mind most likely to promote normal function. Advice on these points will be given in accordance with what has been said in this and other chapters. Other minor ailments may be treated by homely methods, and if they are not relieved, the woman should be sent for medical treatment.

CHAPTER VIII.

DISEASES AND COMPLICATIONS OF PREGNANCY.

THE conditions mentioned under this heading refer to those in which the midwife must advise the pregnant woman to seek medical advice. The C.M.B. (Rule E 21 (2)) give instances of such conditions, but Rule E 20 governs it by the general instruction that all cases of illness or abnormality of mother or child call for medical help.

The first instance is **"Deformity or stunted growth,"** because the pelvis is probably contracted. But if the midwife goes carefully into the history of the previous labours in the case of a multipara, and makes full investigation and measurements in the case of a woman pregnant for the first time, she may discover that the pelvis is contracted in cases in which there is no obvious deformity or dwarfing. These methods of examination are described in pages 200–203. In all small, lame, or deformed women, and in any case in which the history or examination leads her to suspect the possibility of pelvic contraction, medical advice should be sought; also whenever she has any reason to suspect a misfit between the head and the pelvis.

The next conditions are **"Loss of blood"** and **"Abortion or threatened Abortion."** In the early months loss of blood is most frequently due to threatened abortion (p. 89), and in the later months to separation of the placenta, *i.e.* accidental or unavoidable hæmorrhage (p. 206); but other conditions associated with pregnancy are a possible cause, such as the rare instances of menstruation during the first month or two of pregnancy (p. 70), cancer of the cervix uteri (p. 331), injury to the vulva or vagina, or rupture of varicose veins of the vulva; because of the last, "dangerous varicose veins" are specifically mentioned in the part of the rule quoted below.

The last part of the rule of the C.M.B. relating to medical assistance during pregnancy states that any abnormality or complication such as

Excessive sickness,
Puffiness of the hands or face,
Fits or Convulsions,
Dangerous varicose veins,
Purulent discharge,
Sores of genitals,

necessitates the midwife advising that a doctor be called.

Excessive Sickness means that there is severe and persistent vomiting instead of the slight morning sickness which is so common during the early months of pregnancy. The patient vomits after every meal and often between meals. This vomiting, too, does not cease by the fourth month like the simple morning sickness, but continues into the later months;—sometimes it comes on in the later months, and long after the simple vomiting has ceased. In serious cases the patient shows all the signs of starvation—wasting, with sunken cheeks and eyes, dry tongue and mouth with great thirst, the passage of a very small quantity of urine, rising pulse rate and, towards the end, fever. This sickness may be of nervous origin, *i.e.* an excess of the ordinary morning sickness; the stomach is oversensitive, and the slightest thing, food or fluid or even movement or excitement, starts the vomiting reflex. In these cases there is also generally excessive secretion of saliva, and the swallowing of that may suffice to cause the reflex act of vomiting. With rapidly increasing uterine distension such as may accompany twin-pregnancy, hydramnios,

and pregnancy with uterine fibroids, the vomiting may become much more marked, especially if the overdistension of the uterus is of acute onset, as occurs sometimes with hydramnios. In other cases the pernicious vomiting of pregnancy is due to some poison derived from the pregnant uterus, and is therefore one of the manifestations of the toxæmia of pregnancy (p. 224). In such cases the vomiting may commence later in pregnancy, and be accompanied by albuminuria (see below) and perhaps jaundice, the disease being then closely allied to eclampsia. These cases, therefore, require special skill in their investigation and treatment. The nervous cases ought not to be treated at home—they require isolation from friends and home worries, and perhaps rectal feeding for their cure ; and the toxæmic cases require rest and dieting and close observation, as possibly it may be necessary to empty the uterus ; and so neither come within the province of the midwife. But apart from the true vomiting of pregnancy there may be excessive vomiting during pregnancy associated with such intercurrent diseases as chronic alcoholism, gastric ulcer, cancer of the stomach, intestinal obstruction, or tumour of the brain. All cases, therefore, of serious and persistent vomiting during pregnancy must be referred to the doctor at once and before emaciation and the other signs of starvation are manifest.

Puffiness of the Hands or Face is due to dropsical swelling (œdema), which may be present in other parts of the body also : the abdominal wall, the vulva, and, most commonly of all, the legs and feet. The latter are, however, so often affected merely by pressure on the veins by the enlarging uterus, that swelling of the feet while the patient is about, if unaccompanied by swelling elsewhere, is not of the same moment. When the feet swell to a marked degree, careful investigation should be made to see if other parts are affected, and the patient should be kept in bed for a day to see whether it disappears. If it does not disappear when she is off her feet, it is not a pressure effect, and therefore much more serious. The pressure effect is naturally most marked when the uterus is unusually large, as in twins or hydramnios, or when the pregnancy is complicated by pelvic tumours.

This puffiness is associated with kidney disease, and examination of the urine will show the presence of albumin. The amount of urine passed is generally greatly diminished. If accompanied by headache and vomiting, the condition is most serious, and may be evidence of kidney disease or the premonitory stage of eclampsia (p. 224). Weakness of the heart (Introduction, p. 11) and some blood diseases may also be a cause of œdema.

Fits or **Convulsions,** as mentioned in the rules, refer to the occurrence of eclampsia, and therefore reference should be made to the chapter on this subject ; the other forms of fits which may occur will be found mentioned there(Chap. XXI.).

Two other complications of an entirely different character are mentioned in the rule quoted, namely, **" Purulent discharge,"** and **" Sores of the genitals."** The danger of the first is in the spread of infection to other parts of the genital tract after delivery and to the child's eyes, as the discharge may be gonorrhœal. Antiseptic douches will be required, and every effort should be made to cure the patient before her confinement. Sores of the genitals may be due to syphilis and result in the birth of an infected baby, besides being a danger to the midwife should her fingers or hand be inoculated through a small abrasion or crack in the skin. Here, again, rigorous treatment is required to cure the patient before labour comes on. These conditions are discussed fully on pages 324–9.

There are other complications not specifically mentioned in the rules for which medical advice is necessary.

Chorea, or St. Vitus's dance, characterized by constant jerking movements of head, limbs, and body, is possibly another manifestation of the toxæmia of pregnancy and is a serious complication. Persistent headache, neuralgia, sleeplessness, severe itching of the skin or vulva (pruritus), and mental disease (depression of spirits, excitement or delusions) may require medical help. In regard to the last, reference may be made to page 247.

Bladder troubles are not infrequent during pregnancy. The frequency of micturition which occurs in the early months from the enlarging uterus pressing on the bladder has been mentioned. This usually passes off as the uterus rises up into the abdomen, but may recur in the last week or two when the head sinks down

into the pelvis, and when it does so it indicates the near approach of labour. Another and more troublesome cause of frequency is cystitis (p. 248), but such cases are easily recognized because the urine is thick with mucus from the bladder wall, and possibly pus, and has an offensive ammoniacal odour. Retention of urine may occur during the third and fourth months, because the uterus has become jammed in the pelvis and is pressing on the neck of the bladder. This may happen if the uterus is displaced backwards (retroverted), so that as it enlarges it fills up the hollow of the sacrum as, for instance, in multiparæ with relaxed uterine supports and a tendency to " dropping of the womb," as in them the uterus lies far back and low in the pelvis. When it is large enough to fill the pelvis it may right itself and rise up into the abdomen, or abortion may occur. If neither of these events occurs, the condition of *incarcerated gravid uterus* will arise and retention of urine will follow. This incarceration of the pregnant uterus in the pelvis is particularly liable to occur in a flattened pelvis (see Chap. XIX.), owing to the marked projection of the sacral promontory. The bladder may become so distended that it reaches up to the umbilicus ; dribbling of urine will then occur, " retention overflow," so that the patient is never dry. There is generally considerable pain in the lower abdomen and pelvis. A vaginal examination shows that the cervix is high up behind the symphysis pubis whilst the cavity of the pelvis is filled up by a soft swelling—the retroverted pregnant uterus. On passing a catheter a large quantity of urine, two or three pints, will be drawn off and the swelling in the abdomen will disappear. The uterus must be replaced by a doctor, otherwise the trouble will recur. Also, if the condition is neglected, cystitis is likely to follow.

Women who have had many children and in whom the pelvic floor is relaxed are liable to suffer from want of full control over the bladder, which is greatly aggravated by pregnancy. On coughing or sneezing, or rising up quickly from a chair, or on any sudden exertion, urine dribbles away, making them very uncomfortable. A pessary may be required to support the bladder.

Hydramnios is excess of liquor amnii sufficient to cause symptoms of distress from overdistension. Somewhere about three quarts is necessary to do this. The most common time for hydramnios to begin is about the fifth month ; the abdominal distension increases greatly, so that the uterus is much larger than would be expected for the period of pregnancy reached and there is great difficulty in obtaining evidence of the presence of a fœtus. In a well-marked case the patient is much distressed, very short of breath, so that she may not be able to rest lying down but only in a sitting position, there is generally considerable swelling of the legs and vulva from the pressure, and excessive vomiting may be present. Labour often occurs prematurely, and twins are not infrequently born in such cases. In rare cases the hydramnios may come on acutely with much more severe symptoms. A medical opinion is necessary.

If the fœtus dies without labour coming on at once, the patient notices cessation of all movements and complains of a feeling of coldness and dead-weight. The symptoms are not always reliable, and as the condition is not one of urgency, it is best to wait and observe the size of the uterus. If it does not increase, the child is obviously dead.

Any disease or tumour complicating pregnancy adds to the danger of delivery, and some diseases are specially to be feared, chiefly heart disease, kidney disease, tuberculous disease of lungs (consumption). In the first, blueness, shortness of breath, palpitation, and dropsy ; in the second, a pale, pasty and puffy face, dropsy, and the passage of small quantities of albuminous urine ; and in the third, cough, wasting, and fever at night with profuse sweating would make the midwife suspect disease if the patient could not give her the necessary information herself. In all cases in which the patient has been attending the doctor or hospital, the midwife ought not to undertake the case alone unless with the sanction of the medical attendant.

Abortion.

By this term is meant the expulsion of the ovum before the child is viable, *i.e.* before the seventh month or twenty-eighth week. Miscarriage is the popular

expression for the same thing. Some teachers make a distinction between abortion and miscarriage, and would reserve the former for the early cases before full differentiation of the placenta, but no useful object is gained by this, and the two expressions are now generally taken to be synonymous. After the seventh month, when there is a possibility of the child surviving, the expulsion of the ovum is known as premature labour. Naturally there is little or no difference in the process of labour just before and just after the child is viable, *i.e.* between abortion, say at the twenty-sixth week, and premature labour at the thirtieth week. But there is a great difference between an early abortion and a premature labour, and as abortion is most common in the first three months of pregnancy, the early abortion will be the type selected for description. A later abortion is so like a premature labour that little need be said of it.

Abortion is not normal labour, and therefore is not a case which the midwife will attend alone. The C.M.B. Rules are very explicit on this point; medical help must be obtained for "Abortion or Threatened Abortion" (E 21 (2)), and again, in the case of a pregnant woman, for "Loss of blood." And neglect of this regulation may not only involve penalty from the Midwives' Board, but may bring the midwife under the criminal law. To be in attendance alone on a case of abortion will carry a suspicion of procuring illegal abortion or conniving in it, and hence the midwife cannot be too insistent on medical help being summoned at once. If the case is not one of emergency and there is difficulty about obtaining assistance, she should refuse to attend.[1]

Because she may have to render first aid in emergency and may be required to assist the doctor, the C.M.B. regulations specially mention "abortion" as one of the subjects of its examination.

It has been calculated that one in every five pregnancies ends in abortion, and hence women who have been pregnant many times will probably have had one abortion or more. No doubt many occur without the patient's knowledge. The woman may have gone a few days or a week over her time, and then a more profuse loss than usual occurs in which the small ovum is passed unrecognized, and the patient considers it merely as the delayed period. Abortion may even occur before any period is missed. If conception occurs immediately after a period and ends in about three weeks, the abortion may occur at about the time a period is due and with scarcely any more loss than that of the normal menstruation.

The Causes of Abortion are numerous and many cases occur without any obvious reason.

The more common recognized causes may be classified thus:

(1) *Maternal conditions.*

(*a*) General disease, particularly if of the nature of a blood-poisoning, *e.g.* chemical (especially lead), bacterial (such as syphilis (p. 329), malaria, all infective fevers), toxæmia of pregnancy and kidney disease, *i.e.* the maternal blood is unequal to the nourishment of or fatal to the ovum.

(*b*) Pelvic disease, malformation or displacement, tumours, chronic infections (*e.g.* endometritis), *i.e.* the immediate surroundings unsuitable for the further development of the implanted ovum.

(*c*) Accident or disturbance to the pregnancy may be caused either indirectly by accident or disturbance of the mother, *e.g.* fall or blow, over-exertion, severe emotion (as a fright), and internal commotion (as by violent purge or severe diarrhœa), or directly by disturbance of the uterus or its contents, *e.g.* in provoked abortion by the passage of instruments into the uterus damaging the gestation sac or if an operation has to be performed, either on the uterus or other pelvic organs. The early implanted ovum may be detached, wholly or in part, from its uterine bed, causing hæmorrhage, both internal and external, followed by its death and extrusion.

(2) *Paternal conditions* are also given, but little is known of them. Both

[1] "If for any reason the services of a registered medical practitioner be not available, the midwife must, if the case be one of emergency, remain with the patient and do her best for her until the medical practitioner arrives, or until the emergency is over. After having complied with the rule as to the summoning of medical assistance, the midwife will not incur any legal liability by remaining on duty and doing her best for her patient."—C.M.B. Rule E 7.

mother and fœtus may be infected with syphilis at the time of impregnation or later and abortion result.

(3) *Fœtal conditions*, diseases of the chorion (cystic mole) and placenta, hæmorrhage into the membranes (blood mole), hydramnios, fœtal death, etc. In some cases the combination of the sperm-cell and egg-cell appears to be unfavourable to its development and early death of the ovum and abortion occur, *i.e.* the germ-cells of two individuals appear incompatible, but each may be normal, and by mating with others normal pregnancies may occur.

Anything which causes death of the ovum will sooner or later bring about its expulsion, and many of the above mentioned may act by first causing death of the ovum. In some women abortion occurs on very trifling provocation, and a violent cough or a slight stumble may suffice, whilst another woman may fall off the top of an omnibus without disturbing her pregnancy. Abortion is said to be more common at the time the menstrual period is due. Occasionally patients abort with each pregnancy and appear unable to carry to term. In most cases there is some disease or defect of the uterus, and those patients who are subject to habitual abortion ought to see a doctor or attend an antenatal clinic, so that any obvious cause may be remedied. (See Chap. VII., and E (1), C.M.B. Rules.)

The Process of Abortion differs a little from what occurs during natural or premature labour. Generally there is first separation of the ovum with bleeding, then dilatation with further separation is brought about by uterine contractions, and finally these contractions expel the separated ovum. The chief difference, then, is that separation to some degree usually precedes the dilatation and, indeed, is very often the provoking cause of the dilatation and expulsion. The blood extravasated into the uterus and the separated and possibly dead ovum act as foreign bodies and start uterine contractions; these dilate the os and press the ovum into it and finally produce expulsion. The ovum may come away entire—this often occurs in quite early abortions—but after the sixth week the ovum generally comes away in pieces. Till the twelfth to fourteenth weeks, when the placenta is sufficiently differentiated to come away as a whole, it is difficult and usually impossible to say whether everything has come away; before this time the fœtal or chorionic part (p. 58) may be torn out of the decidual or maternal part of the placenta. After this time the ovum may be extruded entire—that is, with the bag unruptured and covered by the decidua, chorion, and placenta—or a mimic labour may occur and the waters escape, followed by the fœtus and then by the placenta and membranes. After the fifth month a mimic labour of this kind commonly occurs and the process closely follows that of a premature labour.[1]

Symptoms.—The chief symptom of abortion is bleeding, but with it there may be pain in the lower part of the abdomen and back, and occasionally sickness.

Varieties and Diagnosis.

Threatened abortion is the variety in which there are signs of separation of the ovum, but no evidence that the process has extended as far as commencing expulsion. If the separation is not too extensive, it may not be sufficient to cause death of the ovum and may heal over, or fresh attachments may be acquired, and the pregnancy go to term and a perfectly healthy child be born. It is just like damaging the roots of a plant; if too many roots are destroyed, the plant will die, but if the damage is only slight, fresh roots will form and the vigour of the plant be unaffected. As it is not possible to tell how much separation has occurred, every threatened abortion must be treated as if gestation might continue and all efforts should be directed towards saving the pregnancy. Every case of hæmorrhage during the first half of pregnancy is to be considered as one of threatened abortion until signs that abortion is inevitable appear.

Inevitable Abortion.—In this variety the hæmorrhage is more severe and is usually accompanied by painful uterine contractions, which cause dilatation of the os. As occasionally the pains subside and the dilatation disappears, abortion is

[1] Reference should be made by the pupil to Chapter IV. (Development of the Fœtus and Membranes) and to Figs. 38 and 39 (representing early abortions) while studying this section.

not absolutely inevitable till extrusion of the ovum begins. When some portion of the ovum is found to protrude through the os, or when the small sac ruptures with escape of the liquor amnii or any part of the ovum, then complete extrusion of the ovum is inevitable, and all efforts must be directed towards assisting nature to complete its expulsion.

Incomplete Abortion.—As, in the early months, the ovum frequently breaks up and comes away in pieces, some portion of chorionic or decidual tissue is likely to be left behind. This is called incomplete abortion and is the cause of many serious complications. It may give rise to serious hæmorrhage at the time, or the bleeding may continue for weeks until the uterus gets rid of the retained products of conception or till they are cleared out by operation ; it may be that by rest in bed the bleeding may cease only to recommence when the patient gets up and about. Sometimes the retained products may set up an unhealthy condition of the uterine mucous membrane, so that the patient suffers from profuse menstrual losses (menorrhagia) when the periods return, or has repeated abortions in the event of subsequent pregnancies. Also retained portions of the dead ovum are very liable to become infected and give rise to septicæmia or sapræmia (p.241), or infection of the uterus (endometritis), or abscess in the pelvis, or other complication. Thus abortion, though often looked upon as of minor importance, is really a common cause of many serious ailments of womenkind. Many women are rendered barren or have to undergo serious and mutilating operations as the result of a neglected abortion.

Missed abortion is an unusual form in which after the signs of threatened abortion the ovum has died but is not expelled, but retained in the uterus for some time, possibly for months, in which case it is finally expelled as a hard rounded mass—a *carneous* or *blood mole.* It is what is popularly termed a " false conception," and the midwife must keep the condition in mind, as the patient does not always recognize that the pregnancy is not continuing. What happens in these cases is that extensive hæmorrhage occurs between the membranes, thus separating the chorion from the decidua and causing death of the ovum ; pains and dilatation do not occur and the retained dead ovum forms into a hard mass ; hæmorrhage from the uterus ceases, though there may be a slight brownish discharge ; the uterus does not enlarge, and the mammary and other signs of pregnancy disappear. The patient for a time will be uncertain as to what has occurred, for there will be no increase in the size of the abdomen and no fœtal movements will be felt, but there will be no return of menstruation, as the uterus is occupied by the fleshy mass. So the midwife may be consulted by her patient to know whether she is pregnant, or because she has passed the expected time of her confinement. Probably she will give a history of having missed one or two periods and then having a slight loss (representing the threatened abortion), and after that no further loss, or only a slight brown discharge, and yet no enlargement of the abdomen or feeling of movements. Such patients ought to be referred to a doctor. Sooner or later an egg-shaped mass with a slightly shaggy surface will be expelled, generally with very little bleeding, as the vessels are thrombosed, and if this fleshy mass is cut across it will be found to be made up of a thick shell of firm blood clot, and in the centre of it a small cavity lined by a smooth membrane. This is the original amniotic sac ; round bosses of clot will bulge the membrane inwards, and possibly hanging by a short stalk will be seen a withered embryo, but often no trace of a fœtus can be found.

Treatment—*Preventive.*—As the prevention of abortion is so large a factor in antenatal work, and as abortion is most frequent in the early months of pregnancy, it is evident that if success is to be obtained the pregnant woman must come early under observation. Patients should be encouraged to engage their midwife and make arrangements for their confinement as soon as they know or even suspect that they are pregnant. The loss of population from the high abortion-rate is greater than that from infant mortality, and to lower it and to diminish the invalidism and incapacity following on neglected abortions, it is essential that the midwife should use her influence to induce her patients to report their pregnancy early.

She may do a great public service by creating around her a knowledge and

consciousness of the criminal nature of all attempts to interfere with the natural course of pregnancy—at however early a period and whatever the means adopted. Something may be done by teaching the women the true significance of what they propose to do, for—usually in ignorance, but sometimes to quiet an uneasy conscience—they fancy that the taking of drugs "to bring back the period," or the procuring of abortion before quickening is felt, does not involve the destruction of life. The educated midwife, knowing that the ovum is living and growing in the uterus before the woman can even tell she is pregnant, and, if undisturbed, will in the fullness of time reach maturity and be born to a separate existence, is in a position to explain that the destruction of a normal pregnancy always means the destruction of life, and is, indeed, but a few short months removed from actual child-murder. To bring home to the individual the crime to the commonweal is not likely to succeed, for few can look beyond their own case and all can see an adequate excuse in their own particular circumstances. A stronger appeal can be made by emphasizing the dangers to the health and life of the woman of the provoked abortion.

Medicines and pills only effect their object if the woman is first poisoned to some degree or a violent gastro-intestinal disturbance produced. If the desired result follows the abortion is likely to be incomplete with all the dangers described under that heading. Interference by mechanical means (*e.g.* the passage of instruments or knitting needles) is extremely dangerous; as these criminal procedures are done by the unskilled, they may result in perforations and other wounds, and, in addition, precautions against sepsis are inadequate. The risk of septicæmia, peritonitis, and pelvic abscess is always greater in abortion cases than in natural labour, and particularly so in provoked abortions. Septic abortions are serious both to life and health.

Apart from these artifically provoked abortions, the prevention of abortion depends on removal of all possible causes (p. 88) by a thorough medical investigation, followed by a careful supervision of the patient and a sound hygiene of pregnancy.

During the process of abortion.—When a woman who has missed one or more periods has hæmorrhage from the vagina, and is therefore likely to abort, the midwife, if called, must explain that it is a case she cannot attend alone and advise that a doctor be called. All she should do is to keep the woman in bed absolutely at rest and, as far as can be, from any disturbing influence. Only when some time must elapse before medical aid can arrive, or when the hæmorrhage is so severe as to be serious, should she examine the patient. If it is only a threatened abortion, repeated vaginal examination tends to disturb the patient and the uterus and make the abortion inevitable. For the same reason no purgatives or enemata should be given. So, unless for some good reason, she should not meddle further therein, but await the doctor's arrival. Everything that is passed should be kept for the doctor's inspection, and, if the midwife does not remain with the patient, instructions to that effect should be given.

If the patient is some distance from the doctor and the hæmorrhage is serious and not controlled by rest in bed, then the midwife must give first aid in the emergency. First, she must try and decide by the signs given above whether the abortion is inevitable; if, on vaginal examination, no dilatation is found and she has with her some sedative as opium, either as a pill or as laudanum (tincture of opium), or chloral or potassium bromide, she should give a dose at once (p. 303) and wait and see if this will check the bleeding. Nothing is better in a case of threatened abortion with severe bleeding than a pill of one grain of opium or fifteen drops of laudanum. If this is ineffectual, it is unlikely that the pregnancy can be saved and the case can be treated as one of inevitable abortion. If pains are present and on examination the os is found to be dilating, and still more if the ovum is protruding, abortion is inevitable, and a vaginal douche as hot as the patient can bear should be given. It will stimulate the uterus to contract and complete the expulsion, after which the hæmorrhage will cease. Some antiseptic solution or boiled water should be used for the douche, and the temperature should be as near 115° as the patient will stand. If this does not check the bleeding, the vagina must be plugged as described on page 210. For the treatment of shock and collapse after severe bleeding, see page 215.

It is very rare to get bleeding in abortion cases so severe that interference by the midwife will be necessary, but she should know exactly what to do in case she should meet with one of these rare cases in a district where medical aid cannot be obtained for many hours. Under such conditions, if the os is sufficiently dilated to allow the index finger to be passed into the uterus, this should be done by pressing the uterus on to the finger by the other hand on the abdomen,

and an endeavour made to hook out the partially or completely separated ovum. If this is done, an intrauterine douche at 118° must be given and a full dose of ergot.

Cases of abortion must be treated as carefully as those of full-time labour. Nothing in the aseptic methods can be relaxed at the time or afterwards, and the patient should have at least ten days in bed. If she makes difficulties, the midwife must explain to her the risks she runs. In cases of incomplete abortion where sepsis has occurred, as shown by the discharges being offensive and the patient's temperature raised, the patient should be removed to hospital, as careful nursing is essential, and possibly some operative treatment may be necessary.

In abortion between mid-term and the twenty-eighth week, a small fœtus may be born alive, move its limbs, give a few gasps or breathe for a time or give out squeaking sounds. Under Act of Parliament these fœtuses count as live born children, and must have both birth and death registered. The midwife is responsible for this if no doctor is present at the birth (p. 324).

The rarer causes of hæmorrhage in early pregnancy are—1. Cystic mole; and 2. Extrauterine pregnancy.

1. **Cystic, vesicular, or hydatidiform mole** is a degeneration of the chorionic villi into strings of small bladder-like cysts or vesicles, thus greatly increasing the size of the ovum. The cysts are about the size of a currant and occur in enormous quantities and before formation of the placenta; there is generally no trace of embryo or fœtus. Hæmorrhage and increase in size of the uterus beyond that proper to the stage of pregnancy are the chief signs, but in some cases undue enlargement of the uterus is not present. Very often the sickness of pregnancy is more marked than usual and albuminuria is more common than with normal pregnancy. There are usually no signs of a fœtus. When the mole begins to be extruded the small cysts may be discovered in the blood and clot, and the traditional description of them is of " white currants in red currant jelly." The diagnosis is not often definitely made before extrusion, unless a finger can be passed into the uterus and recognizes the jelly-like feel of the mole. The mole is generally passed by the third or fourth month and with severe hæmorrhage. It is a dangerous condition because of (1) the hæmorrhage, (2) septic infection, (3) the possibility of rupture of the uterus because the degenerate villi damage the wall, (4) the possibility of a malignant growth (chorion-epithelioma) following it.

All that the midwife should know is, that such a condition occurs, that she must get a doctor at once should she suspect its presence, and till his arrival treat severe hæmorrhage by hot vaginal douches, ergot, and by plugging of the vagina and applying a firm abdominal binder (p. 210). When the patient is suffering from collapse from excessive hæmorrhage, she should be treated as described on page 215.

2. **Extrauterine Pregnancy.**—The midwife should also know that this serious condition may occur as the result of the ovum remaining in the Fallopian tube after fertilization (p. 55) instead of coming into the uterus. Commonly the pregnancy ends very early in abortion through the fimbriated end of the tube, the ovum and blood being expelled into the peritoneal cavity where it usually forms a blood mass (pelvic hæmatocele); sometimes the tube ruptures, causing serious internal hæmorrhage, and very rarely the fœtus may survive and develop in the abdominal peritoneal cavity to term, when it dies, and, unless removed by operation, may cause the death of the patient. One important fact about such cases is that the decidua forms in the uterus even when the conception is outside it and is shed when the ovum is aborted from the tube or when it dies, and that there is uterine hæmorrhage during the shedding of the decidua from the uterus. Menstruation ceases because the endometrium is formed into decidua (p. 56). The chief symptoms of this condition are—(1) *Amenorrhœa*; the patient misses one or more periods; very often after having gone two or three weeks over her time, there is an attack of (2) *severe abdominal pain,* due to the extrusion of the ovum from the tube and bleeding into the peritoneal cavity. The pain is generally sudden in onset, severe, and sometimes accompanied by sickness, fainting, and, in cases of tubal rupture, with extreme bloodlessness and collapse from internal hæmorrhage. (3) *Uterine hæmorrhage.* which usually begins about the same time as the pain

and is not great in amount, but continues for a long time and is sometimes rather dark in colour. (4) *The decidua may be passed* as a cast of the uterine cavity—rather like the finger of a glove. This, however, is rare, the decidua commonly coming away in small pieces. The passage of anything like a skin or membrane is a very important item in the diagnosis, and hence anything of the kind should be carefully preserved for inspection.

All serious cases of this kind are treated by abdominal operation ; the gestation sac in the tube is removed, the vessels running to it being secured.

PART III.—LABOUR.

CHAPTER IX.

THE PHYSIOLOGY OF LABOUR.

Definitions.—By labour we mean the processes by which the contents of the uterus are expelled after the fœtus has reached a viable age. There is practically no chance of the fœtus surviving if it is born before the twenty-eighth week, and therefore before this time the expulsion of the ovum is termed "abortion" or "miscarriage." Labour occurring after the twenty-eighth week (counting from the beginning of the last menstrual period), and before full time, which is approximately the fortieth week, is known as premature labour. A child born within these limits may survive, and the chance, at first a very slight one, becomes progressively better as we approach term.

The Onset of Labour.—We do not know what determines the onset of labour, and we cannot predict the day on which it will occur, for there are uncertain factors at both ends of the pregnancy. We do not know the exact date of conception, for it may not occur till days or even a week after connection, so that even if we could calculate from the date of a single intercourse, there would still be a margin for error. For instance, in the case of domestic animals, where the day or hour of mating may be definitely known, the duration of the pregnancy to a day cannot be predicted. Near and about term the uterus is in a state of unstable equilibrium, and a very trifling cause may bring the scale down on the side of labour. The apple is ripe and ready to drop off the tree, but in calm weather it may be days or even a week before this happens, but a gusty day or a shake of the tree will bring it down at once. So if the patient is leading a quiet and undisturbed life her pregnancy may continue, whereas extra exertion, emotion from excitement, an internal commotion from indiscretion in diet or a strong purge, may shake the uterus into action a few days before it otherwise would have begun. For these reasons, then, the only practical means of calculating the date of the expected confinement is from the cessation of the menstrual periods. Two hundred and eighty days from the beginning of the last period will, in the vast majority of cases, be within a few days of the time of the confinement, and the quickest and simplest way to calculate this is to count back three months and add on a week. Thus the first day of the last period was 1st November, count back three months brings us to 1st August, add on seven days gives us 8th August; the confinement may be expected within a day or two on one or other side of that day. As the months are not all of an equal number of days, this method does not give 280 days exactly, but it is sufficiently near for all practical purposes. A source of error which must be kept in mind has been mentioned already (p. 70) in those rare cases where one or two periods, usually very slight, occur after conception, and where bleeding occurs from threatened abortion, and is mistaken by the patient for a true menstrual period.

Occasionally it may happen that a patient becomes pregnant during a period of amenorrhœa, during suckling or ill-health or other cause, or when there have been erratic losses, so that the proper menstrual history is unobtainable or unreliable. In such cases the expected time of delivery must be worked out from other data, and will be liable to a much wider margin of error. The midwife will have to rely chiefly on the height of the uterus, and the earlier and the more often observations are made, the nearer will she be to the correct time. For instance, she sees a woman who suspects she is pregnant though she has not menstruated since her

last child, now a year old, was born, which she was nursing till four months ago. She had to cease nursing because the milk diminished greatly in amount and became poor. She is found to be pregnant, and the uterus to be half-way between the umbilicus and pubes. From this she is thought to be 4½ months pregnant. She is seen again six weeks later, and the uterus found to be just above the umbilicus—this corresponds to what would be expected, and so also does an examination six weeks later when the fundus is half-way between the umbilicus and the breast-bone. But there are other factors which will help. Quickening is generally noticed about the mid-term—the eighteenth to twentieth week—so if the patient has noted the time of quickening, twenty weeks after that ought to be about the time of the confinement. If she has had morning sickness, it will probably have begun four to six weeks after conception. Some idea of the correctness of the calculation may be obtained about two months before delivery, because the fœtal parts ought then to be made out definitely and the fœtal heart easily heard, though it may not as yet be easy to count it.

There are no reliable signs that the onset of labour is imminent, although some multiparæ from experience in previous pregnancies may recognize that labour is likely to set in within a few days by the sensations which accompany "lightening" (p. 67). The head sinks into the pelvic cavity and the fundus of the uterus sags forward and downwards so that breathing is easier and the woman feels "lighter" and more comfortable from the increased accommodation in the abdomen. Some frequency of passing water and a sense of pressure in the lower abdomen and pelvis may accompany this change and, with "grumbling" pains and false labour pains, may warn her that her time is near. The pressure of the head on the sacral nerves may also cause pain in the legs and back, and cramp. The signs indicating the actual onset of labour will be found on page 123.

Labour.

With the onset of labour the means must be considered by which the passages are opened up and the whole ovum, child and after-birth, expelled.

To begin with, the pupil must have a clear idea of the factors concerned in labour. There are the *powers* engaged in doing the work; chiefly the uterine muscle, but the auxiliary muscles of the abdominal wall also take part. The work done by these powers is first of all the opening up of the soft *passages*, *i.e.* the lower part of the uterine body, the cervix and vagina, and secondly, the expulsion of the *passenger*, *i.e.* the fœtus and its envelopes, against the resistance offered by the bony canal of the pelvis and the soft genital canal. Hence we have to consider how the power is developed, and how it works to effect its purpose. The processes of labour are divided into three stages, and they are most conveniently described in these three stages, but it must be understood that nature does not work by fits and starts, and that labour does not take place in three separate jerks, but that the processes of one stage may take place concurrently with those of the preceding or succeeding stages.

The three stages are:

The First Stage or **Stage of Dilatation,** from the commencement of active labour pains to the full dilatation of the os.

The Second Stage or **Stage of Expulsion,** from the full dilatation of the os to the birth of the child.

The Third Stage or **Placental Stage,** from the birth of the child to the expulsion of the placenta and membranes.

Not only is the physiology of labour best considered in these three stages, but in the lying-in room the progress of labour is equally well observed clinically in these same three stages, but the warning given above must be borne in mind. For instance, before active labour pains begin, and hence before the first stage as defined above has commenced, some of the work which is described under the first stage has already been done, and is sometimes described as the premonitory or preliminary stage leading up to the first stage. Again, some descent of the fœtus takes place before the second stage or stage of expulsion begins, and some of the processes

described in the third stage will continue after the completion of that stage. If this is clearly grasped by the pupil, there is a very great advantage to be gained in considering the processes of labour in these three separate stages.

The Physiology of the First Stage.

Arrangement of Muscle in Uterine Wall.—In this stage the power at work is solely that of the uterine muscle, the accessory muscles do not come into play till the stage of expulsion, and therefore the first thing to be described is the arrangement of the muscle fibres in the uterine wall. The pregnant uterus at term is shaped rather like a soda-water bottle turned upside down. The main part of the bottle, representing the body of the uterus, is filled by the bag of membranes containing the liquor amnii and fœtus, whilst the neck of the bottle represents the cervix. The uterine wall, stretched by the growing ovum, is very thin, less than a quarter of an inch and less than half the thickness of the non-pregnant organ. This wall is made up of interlacing bundles of muscle fibres woven together like the threads in a piece of cloth. An individual muscle fibre may be compared to a thread of elastic. When relaxed, it is like an elastic thread stretched out and thin ; when contracted, it is like the same thread unstretched, *i.e.* thicker and shorter. The uterine wall, then, is to be thought of as made up of thin muscle threads, interwoven in all directions, but chiefly in three groups. First, there are *longitudinal* fibres which run up and down, from fundus to cervix ; then there are *circular* or *transverse* fibres, running round and round the body and cervix, and specially marked round the openings of the Fallopian tubes and in the cervix and at the internal os ; finally, there are *oblique* fibres, running diagonally across from one corner to the lower part of the body on the opposite side, but these are not so numerous or so evident as the longitudinal and transverse fibres. Besides these there are small bands of interlacing fibres round the large blood vessels, some of them forming double rings or figures of **8,** which are of importance in checking the circulation through the uterus and in preventing hæmorrhage after delivery. If the simile of these muscle fibres to stretched elastic threads is kept in mind, it will easily be understood that when they contract they shorten and thicken, as the elastic would if it was no longer kept on the stretch, so that the uterus becomes shorter and narrower and its walls thicker and harder and at the same time exercises a very considerable squeeze on its contents.

Character of Uterine Contractions.—The uterine contractions are involuntary, *i.e.* are unaffected by the will, and occur in conditions of complete insensibility, such as full anæsthesia or eclamptic coma, though they are affected by nervous influence, reflexly or from emotional disturbance. They appear to originate in the uterine muscle itself, like the heart-beat in the cardiac muscle, and also to be influenced by impulses from the central nervous system like the heart's action, but, as already explained in the Introduction, p. 20, the centre for labour is not in the medulla with the cardiac and respiratory centres but in the lumbar region of the spinal cord. Contractions may be started or increased in strength reflexly by such causes as the irritation of a foreign body in the uterus (for example, the bougie or bag introduced to induce labour, p. 315), by dilatation of the cervix (by the bag of membranes or presenting part in normal labour or by bringing down a leg or putting in a bag in abnormal labour, p. 209), or the stretching of the vagina and perineum by the presenting part. The contractions produced after labour by putting the baby to the breast are another instance of reflex stimulation of the nerve centre. On the other hand, massage and heat applied to the uterus probably act directly on the uterus and not by reflex nervous action. An anæsthetic like chloroform, or a sedative drug like morphia, slows labour by abolishing or diminishing the reflex excitability of the nervous system, so that it responds less readily to stimulation. Fatigue, anxiety of mind, emotional disturbance, and severe pain, acting through the nervous system, tend to check the flow of impulses and thus inhibit contractions. The traditional example of this is the excitement of the attendant's arrival driving away the pains ; in illustration of its application to practice the necessity of keeping the woman in labour quiet and reassured (p. 143) may be quoted. Distension of the bladder and loading of the colon also have a reflex influence in inhibiting uterine

action (p. 143). Though the whole uterus appears involved in a contraction, it is probable that the contraction really begins at the fundus and spreads downwards in a wave-like manner, similar to that of peristalsis in the bowel (Introduction, p. 15). Such peristaltic contractions occur in the tubal uteri of the lower mammalia, and occasionally, *e.g.* in cases of extreme uterine distension from hydramnios, such wave-like contractions have been observed in the human uterus.

Infrequent at the onset of labour, the contractions become more definitely rhythmical as their duration and frequency increase, until, with the stimulus of the distension of the vagina and vulval outlet by the presenting part, a storm of strong expulsive pains may rapidly complete the birth of the child.

Labour pains, or *painful uterine contractions*, mark the onset of active labour. Throughout pregnancy and especially during the later months occasional uterine contractions occur and can be felt by palpation, but they are painless and have no effect on the cervix, at any rate until within a few days of term. Like the normal

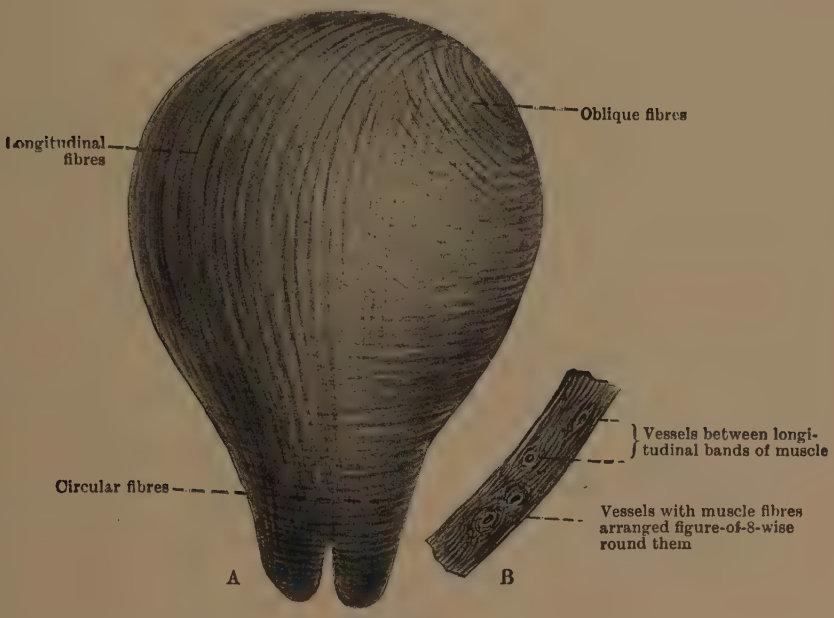

FIG. 45.

A. Scheme of arrangement of uterine muscle fibres.

B. Diagram to illustrate the compression of vessels in the uterine wall by the contraction of its muscle fibres.

peristaltic movements of the bowel, the contractions of pregnancy are not noticed; the contractions of labour seem to be a kind of uterine colic like the intestinal colic caused by a strong purge. Another point of difference between them is that the contractions during pregnancy are unaccompanied by retraction, *i.e.* are followed by complete restretching or relaxation of the muscle fibres, and therefore no dilatation occurs to cause diminution of the intrauterine tension. Sometimes, however, the patient may have several days of infrequent pains before labour starts, and it is not uncommon, whether such pains have been noticed or not, to find at the very commencement of labour that not only has the cervix been taken up but that the os is already dilated to the size of a florin (=the premonitory stage). When labour has definitely started, painful contractions begin, occurring at first at long intervals of half an hour or more and lasting for quarter of a minute or less, and gradually increasing in frequency, duration, and strength. This is known as the "rhythmical" character of the pains, and helps to distinguish true labour pains from false pains (p. 123) of a colicky kind. The cause of the pain of labour is largely the muscular pain of the uterine contraction, but in addition there is the pain caused by the forcible stretching of the soft parts, cervix, vagina, and perineum. The pain is most severe

during the actual birth of the child, because there is then both the strongest contraction and most marked retraction of the uterus as well as the greatest distension of the soft parts.

If the uterus is palpated during a pain, the following points may be observed. First, that the patient feels the pain before any change in the uterus is perceptible to the hand placed on it. Then the uterus is felt to harden and stand up more distinctly; when the hardening has reached its height the fœtal parts cannot be felt, and for a few seconds the uterus remains in this hard state, then relaxes again, rather more rapidly than it hardened, and remains soft and relaxed till the next pain starts. In a patient with a thin abdominal wall, the occurrence of the pains is plainly visible when the patient is lying on her back. The uterus can be seen to become stiff and more erect and to stand out against the abdominal wall, and then as the pain passes off to become less prominent and sink backwards again. While attending her cases the pupil ought to take every opportunity in all stages of labour of feeling the uterus during its contractions and trying to form an estimate of their strength, from the degree of hardening and the time it lasts. She will notice that the pains vary greatly, and that in half a dozen successive pains some will be stronger and last longer than others, and that the tendency, as labour progresses, is for the pains to increase in strength and duration. To be able to form some estimate, however rough, of the character of the pains will be seen to be of great value in recognizing the causes of delayed labour.

Most of the effect of the contraction is produced during the time when the uterus is hardening; when once the contraction has reached its height, and for the short time it remains at its height, little effect is produced, and of course none at all during the relaxation and the period of rest. But the intermittent character of the pains is most important in another way. It gives not only a time of rest to the mother, but allows the circulation to go on through the uterine wall and thus to the placental site so that the fœtal respiratory exchanges can continue. During a contraction the fœtal heart-beat is slowed and becomes feebler, but recovers again in the intervals, and in cases of rapidly succeeding pains with short intervals, the fœtus, if it is not born quickly, may die from interference with the placental circulation; death of the fœtus will be seen to occur invariably in those cases of obstructed labour in which the uterus passes into a stage of continuous contraction (p. 194). The uterine souffle (p. 74) rapidly diminishes as the contraction progresses and cannot be heard at all at the height of the contraction, showing that the circulation has been checked for the moment.

Upper and Lower Uterine Segments.—The action of the uterine muscle in labour must be considered as similar to that of the muscular walls of other hollow viscera in the body during the evacuation of their contents, but modified to meet the special circumstances involved in the expulsion of a living fœtus instead of non-living waste material. A comparison with the action of the bowel in peristalsis and during defæcation (p. 16) and of the bladder in micturition is both helpful and educative and will be frequently used in this chapter.

In the first stage of labour a process occurs analogous to the relaxation of the sphincter muscle of the bowel or bladder, with contraction of the muscular wall. The muscular fibres in what may be termed the neck and shoulder of the uterus (Fig. 45) relax, whilst the fibres of the body contract. The uterus has therefore been differentiated into an upper and a lower segment based on the difference in the muscular action in the two portions, the upper segment comprising the main part of the body and the lower the shoulder and neck. As the latter must open to allow the child to pass, it will be understood to be the expansile segment, while the upper is the contractile segment which stretches out the more passive lower segment. No definite anatomical line can be marked out between the upper contractile and lower expansile segment, and indeed the division between the two is not constant in position but tends to move upwards during labour, more of the uterus being taken into the lower segment. The differentiation into upper and lower segments can only be made out in the pregnant uterus—not in the non-pregnant—and is not an anatomical but a physiological distinction, *i.e.* it is based solely on a difference in function. It is similar to what occurs in the bowel during peristalsis—an upper

section contracting and squeezing its contents into a lower, which is dilated. In the intestine, also, the differentiation between the contracted part and the relaxed part is physiological only. As the contraction passes rapidly down the bowel an isolated portion must be imagined with the upper half in contraction and the lower correspondingly stretched by the matter squeezed into it.

Roughly the lower uterine segment, with which the cervix is best included, is the portion below a radius of about $1\frac{1}{2}$ to 2 inches round the internal os, about the level of the attachment of the peritoneum on the anterior wall of the uterus; all above this functions as the active contractile segment. Not only does contraction of the upper segment produce relaxation and dilatation of the lower segment, but the converse holds good, and stretching and dilatation of the lower segment will cause contractions in the upper segment. The term **"Polarity"** of the uterus is used to denote the opposite effects which one pole of the uterus produces in the other from a fanciful resemblance to the action of the poles of a magnet, one of which attracts and the other repels. The term must be cautiously used, as it may lead to loose thinking: it might equally well be adopted for describing the muscular actions of defæcation and micturition in which the sphincter muscles relax, like the lower segment, while the muscular walls of the viscus contract, like the upper segment, to expel its contents. The opposite effect, as described under polarity, of the dilatation of the lower segment producing contraction of the upper, finds a parallel in the stimulation of the intestine by dilating the sphincter or distending the lower bowel, as used practically, for instance, in starting evacuation of the bowel in the infant by inserting the little finger or a piece of soap, or in an adult by the use of an enema.

Retraction.—During a contraction each individual muscle fibre of the upper segment becomes thicker and shorter, so that this part of the uterine wall thickens and shortens, thus compressing the contents; as the contraction passes off the pressure of the contents stretches the fibres again. Owing to the thinning and opening up of the lower uterine segment, the bulging of the bag of membranes, and still more to the gradual extrusion of the uterine contents, the effect of the intrauterine tension in restretching the muscle fibres progressively diminishes, so that after a contraction the muscle fibres are not pulled out to their original length and some permanent shortening and thickening remains. This permanent shrinkage of the muscle fibres producing a progressive thickening of the uterine wall is termed "retraction," and as it has extremely important consequences, in maintaining progress already made, in producing separation of the placenta and membranes, in checking hæmorrhage and, in abnormal labour, leading to grave complications to mother and child, it requires further explanation. If the muscular wall of the uterus is considered as kept on the stretch by its contents, the result of the withdrawal of tension, as by its rapid emptying, would be an immediate shrinkage or retraction of its muscle fibres. This may be seen to occur at a Cæsarean section, even if performed before the onset of labour pains. With the escape of the liquor amnii and the removal of the child, the fundus shrinks down from the ribs to below the level of the umbilicus, the uterine wall undergoes great increase in thickness, and the cavity is enormously diminished in size. In natural labour marked retraction occurs with the escape of the waters and still more with the birth of the child. What takes place in a few moments in a Cæsarean section takes place slowly and gradually in normal labour, so that it is spread out over the whole time from start to finish. It is most easily observed at the end of the second stage by the hand on the abdomen following the descent of the fundus during the escape of the child. By retraction, therefore, is understood the permanent contraction of the muscle fibres resulting from their not being drawn out to their old length after active contraction owing to the tension being lessened by the escape of the uterine contents. Exactly the same process occurs as the bladder empties; its walls, no longer kept on the stretch by the tension of the contained urine, shrink down so as to obliterate the cavity of the bladder, becoming much thicker in so doing. Then as the bladder fills up again its wall is restretched and thinned out. The difference between the retraction of the muscle fibres of the bladder wall and uterine wall is one of degree; the retraction in the bladder is a feeble affair compared with that in the uterus, corresponding

to the weakness of its muscular coat in comparison with that of the uterus. In washing out the bladder it is easily redistended by running in fluid through a tube and funnel attached to a catheter held but a little distance above the level of the bladder. Uterine retraction is so powerful that even with all the relaxation to be obtained with full anæsthesia little can be done in the way of pushing back the presenting part, and once firm retraction has advanced or been present for some time such attempts will be more likely to cause rupture of the thinned out lower segment than restretching of the muscle fibres of the upper segment.

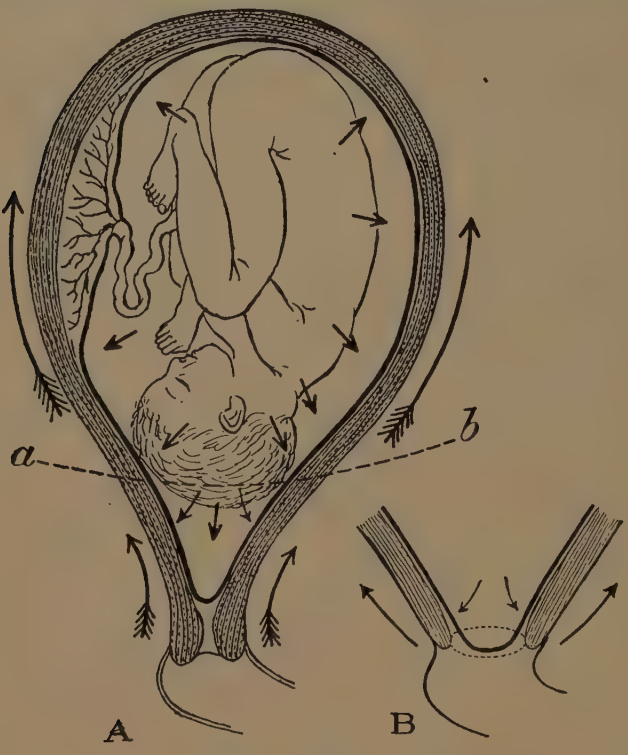

Fig. 46.

A. Scheme to show the Effect of Uterine Contraction before Rupture of the Membranes.

The line *a*.....*b* marks the division between the upper and lower uterine segments. The longitudinal muscles are indicated by lines in the uterine wall; the circular muscles by dots. The large arrows show the pull of the longitudinal muscles on the lower segment, thinning it out and drawing the cervix open and up over the bag of waters. With each contraction of the uterine musculature the pressure on its contents is raised and distributed in all directions through the fluid as shown by the small arrows. The pressure will be ineffective above the line *a*.....*b*, as the firm contracted walls will resist it; below *a*.....*b* the pressure will tend to stretch the relaxed and thinning lower segment and to press the bag of waters into the opening os.

B. The "Fluid Wedge Action" of the Bag of Waters.

The membranes, separated by the thinning out of the lower segment, are pressed down as a tense pouch into the os, thus tending to force it open. The small arrows indicate the effect of the intrauterine pressure on the projecting bag of waters, the large arrows, as before, show the upward pull of the longitudinal fibres.

Dilatation and Action of Bag of Waters. — In order to understand how the uterine contractions stretch the lower segment and open up the cervix, let us consider what would be the result of the contraction of each group of fibres. Though these fibres run in all directions, to appreciate the effect of their contraction they may be considered as of two kinds, the circular, or those running round and round the uterus, and the longitudinal, or those running up and down. Those which run obliquely will evidently have partly the effect of one and partly the effect of the other, varying in degree as they are more nearly transverse or longitudinal. If they are just midway between the two, they would have half the action of one and half the action of the other, and in proportion as the direction of these oblique fibres is more nearly longitudinal or more nearly transverse, so will their effect be more nearly that of the longitudinal or transverse respectively.

The effect of the circular fibres is easier to understand and therefore is better taken first. When the fibres contract they tend to narrow the cavity of the uterus and therefore will squeeze the uterine contents as the hand does the contents of a Higginson's syringe when it squeezes the ball. This increased intrauterine pressure will be distributed through the fluid in the uterus in all directions, but it cannot have any effect upwards against the firmly contracting fundus, nor on the sides

against the actively contracted upper segment, but below it will stretch the lower relaxing segment and will squeeze the bag of waters into the cervical canal.

When the longitudinal fibres contract they will tend to shorten the cavity of the uterus and cause pressure on its contents. They run from the fundus or bottom of the bottle to the cervix or neck of the bottle, and therefore when they shorten they will tend to pull the cervix open and up over the bag of membranes, this action being assisted by the relaxation of the muscles of the lower segment and cervix. The effect of the longitudinal muscles in pulling the cervix up over the bag of membranes or presenting part is similar to that of the levator ani muscle in pulling the lower end of the rectum up over the fæcal mass in the act of defæcation (p. 16).

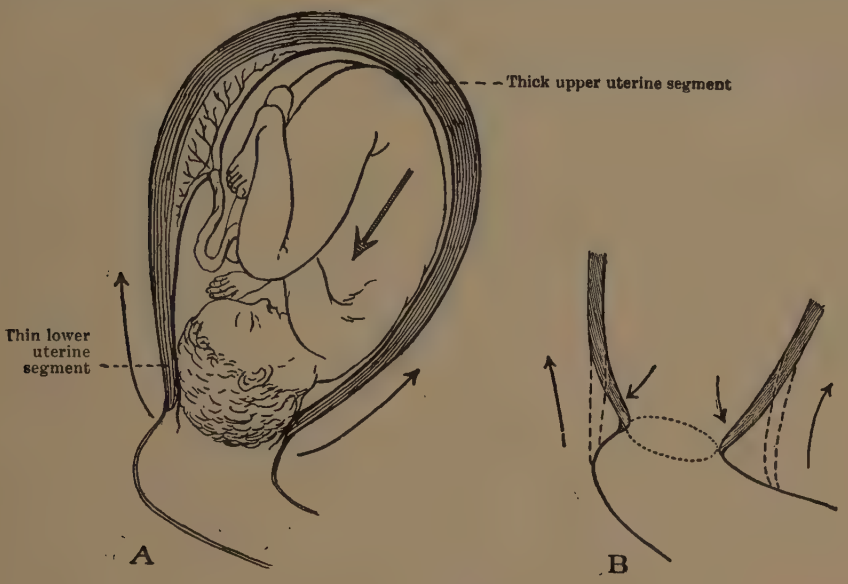

FIG. 47.

A. SCHEME TO SHOW THE EFFECT OF UTERINE CONTRACTION AFTER RUPTURE OF THE MEMBRANES.

The head has come down into the os and prevented the escape of the hind waters. The uterine pressure is now more directly communicated to the child, which it tends to push downwards in the direction shown by the thick arrow. If the os is not fully dilated, the head will continue the wedge action of the bag of waters and the longitudinal muscles will pull the rim of os up over the head as shown by the thin arrows. The marked thickening of the upper segment and thinning of the lower segment is shown.

B. SCHEME TO SHOW THE DRAWING OUT OF THE LAST RIM OF OS.

The pressure of the head or of the bag of waters is shown by the small arrows, the pull of the longitudinal fibres by the large arrows. The rim of os is indicated by the fine dotted circle. The result of the pressure and the pull will be to draw out this narrow portion of the genital canal so as to produce the condition indicated by the interrupted lines. The first stage will then be complete.

The internal os is first pulled open and taken up into the uterine cavity, and then the cervical canal is opened up so that only the external os is left. The shape of the uterus is now no longer that of a soda-water bottle but rather that of an egg-shaped jug with a narrow mouth, for the shoulder and neck of the bottle have been smoothed out (Figs. 46 B and 47 A). If the patient was examined at this stage, no cervical canal would be present, but only an os with a small opening admitting, say, the tip of the finger, and when the finger is passed through the os it would come straight on to the bag of membranes. This teaches us that if a patient is thought to be in labour and is found to have the cervix still present so that the finger has to pass through an inch of cervical canal before reaching the membranes, then she is either not in labour at all or in so early a stage that delivery need not be expected for some time.

What is known as " the fluid wedge action " of the bag of waters must be more fully explained. As the lower uterine segment stretches, the membranes there are separated. Slight bleeding results, and, with the discharge of mucus from the cervix, causes the " show " which usually occurs at the commencement of labour. The result of this separation is the formation of " the bag of waters," *i.e.* the lower part of the amniotic sac is pressed down through the os with each pain and projects as a tense pouch, thus helping to force it open.

This process is continued throughout the first stage. With each contraction the general intrauterine pressure is raised and the relaxed lower segment is stretched and thinned out, the bag of waters bulges through the os, which becomes more and more opened, so that it feels like a thin membranous ring. At the same time that the upper segment is pulling this ring of os up and open, it is, owing to the retraction of its fibres, becoming thicker as the lower segment is becoming thinner. The membranes bulge more and more, and as they are unsupported below, there comes a time when the pressure is so great that they burst. This ought not to take place till the os is fully or nearly fully dilated, but it sometimes happens quite early in the first stage. When the membranes rupture before full dilatation, only that portion of the liquor amnii in front of the head (=the fore-waters) escapes and the head comes down like a ball valve into the os and keeps back the rest of the liquor amnii (=the hind-waters). In such cases the head comes into the os and continues the wedge action begun by the bag of waters. The ball-valve action helps to preserve the bag of membranes as the head coming down and plugging the lower uterine segment keeps off the full force of the intrauterine pressure from the membranes below it (Fig. 46, A). When, owing to pelvic contraction or malpresentation, the head cannot come down to plug the cervix and keep off the full intrauterine pressure, the membranes rupture early in labour.

When the os is nearly fully dilated the birth canal forms a large cavity above, the uterine cavity, containing the fœtus and its envelopes, separated from the vagina below by a thin projecting rim or fold, the undilated portion of the os. When this projection round the canal at the level of the os is drawn out so that the uterus and vagina form one canal with smooth walls, the " canalization " of the passages is complete. It is easy to understand how this is effected. If the membranes are still unruptured, the pressure exerted by each contraction squeezes the bag of membranes through this narrower part of the canal, and the longitudinal fibres running from the fundus down to this part draw this fold and the fundus nearer together ; but as they cannot come together because of the incompressible contents of the uterus, they will evidently pull out the fold. If the membranes are ruptured, the uterine wall will exert more direct pressure on the child, but the effect of the longitudinal muscle fibres will be the same ; in shortening, they will draw this fold up towards the fundus, and at the same time press the child's head down through the narrow rim ; the result will be that the rim of cervix will be drawn up above the head and the fold smoothed out (Fig. 47). When the uterus, cervix, and vagina are thrown into one canal, the " canalization " of the passages is complete and the first stage is over. Owing to the retraction of their muscle fibres the walls of the upper active segment are thicker than they were before labour began, and this segment is therefore slightly shorter than it was, but the actual length of the uterine cavity is not altered because the lower segment has been correspondingly thinned out and stretched. The inverted soda-water bottle shape of the uterus has entirely gone, the neck and shoulder of the bottle have been stretched out to the same size as the cavity, and the divisions between uterus and cervix and cervix and vagina have been completely smoothed out. So perfect is this that in cases in which the passages have been opened up and examined after the death of a patient in the second stage of labour, it has been found extremely difficult to tell where the uterus ends and the vagina begins.

It should be noted that during this stage of labour the child makes little advance, and that the auxiliary muscles are of no use and ought not to be brought into action.

It is the longest stage of labour—sixteen to eighteen hours in a primipara and about half that time in a multipara. The longer time required for dilatation of the cervix in primiparæ is the reason for the difference in duration.

The Second Stage.

This stage begins when the dilatation of cervix is complete, whether the membranes are ruptured or not, and is recognized clinically by the lips of the os being drawn up above the projecting bag or over the head so that they can no longer be felt. The two chief points to consider in the physiology of the second stage are—(1) the forces which act on the child, and (2) the way in which the lower part of the genital canal, the vagina and vulva, are opened up to allow of the passage of the child.

The Expulsive Forces.—The expulsion of the child is brought about by the contractions of the upper segment of the uterus, assisted by the abdominal muscles, acting on the child through its spinal column and pushing it downwards in the direction of least resistance, *i.e.* through the dilated genital passage. In the first stage the stretching of the lower segment by the general intrauterine pressure was described. In the second stage this general pressure is replaced by the direct uterine pressure ; that is, the membranes being ruptured, some of the liquor amnii having escaped and the uterine wall having retracted down so as to clasp the child more closely, the effect of each contraction is more directly communicated to the child itself so as to press it downwards. The upper active segment squeezing on the breech and body of the child forces it and, through it, the head down the vagina. Two factors which assist in this movement call for special consideration here : they are the retraction of the uterus and the bearing-down action of the abdominal muscles.

As already mentioned, retraction occurs during the stage of dilatation, but it is most marked during the expulsion of the child. The retraction which has already taken place has resulted in the wall of the upper segment becoming thicker, so that instead of being $\frac{1}{4}$ inch, as before labour began, it is now nearly $\frac{1}{2}$ inch, whilst the lower segment is so thinned out that it is only about $\frac{1}{8}$ inch thick. With the escape of the child from the upper segment of the uterus there is a rapidly diminishing intrauterine tension to restretch the muscle fibres after each contraction, and hence the permanent shortening or retraction becomes marked and serves to maintain during relaxation the advance made during contraction. An apt illustration of this effect of retraction has been given by likening it to a man hauling a load from the ground to a scaffold by means of a rope (=contraction) and taking a rest when the load is half-way up (=interval between contraction). If he lets go, the load drops to the ground and all his work has to be done again (relaxation without retraction) ; but if he hitches the rope to a post and so keeps the load in the position reached (=retraction), his next effort (=renewed contraction) begins where the last left off. If the uterus is thought of as an overstretched elastic bag which shrinks down as the child escapes, and by its shrinking prevents the child going back, it will give the pupil a very good impression of what is taking place. Some restretching of the muscle fibres immediately after a contraction may be seen at the end of the second stage with a strong and resilient pelvic floor—say in a primipara with a tight perineum. The head distends the outlet with each pain, but, as the pain passes off, is pressed back by the elasticity of the soft parts. Delay will occur owing to the partial restretching of the muscle fibres by the recoil of the pelvic floor after each contraction. In this way retraction is held back till the resilience of the outlet is weakened by its distension and the contractions increasing in strength force the head out.

The assistance given by the abdominal muscles must now be explained (see Introduction, p. 16). This is known as the " bearing-down efforts " and forms one of the characteristic features of the pains of the second stage. The patient fixes her pelvis by pushing her feet against the foot of the bed and fixes her shoulders by holding on to a towel. The next thing she does is to fill her chest and hold her breath, thus pushing down her diaphragm to the utmost and so raising the pressure in the abdomen. The abdominal muscles are then contracted strongly and the pressure in the abdomen further increased. This pressure will act in the direction of least resistance, pushing the uterus and its contents downwards towards the dilated genital canal. These bearing-down efforts will be most effectual when the greater part of the child has escaped from the upper segment of the uterus,

because with each contraction the firmly retracted upper segment of the uterus will be pressed down on the child and so will push it further down the canal. Hence the abdominal muscles have an important auxiliary effect, especially as the head gets near the outlet, but they are by no means essential. Labour can go on without them, and when they are feeble, as in pendulous abdomen, or inactive, as in cases of paralysis, or when the patient is deeply under chloroform, or suffering from serious heart or lung disease, so that she cannot hold her breath, the child may yet be born naturally and sometimes rapidly. But lack of assistance from the auxiliary muscles prolongs labour.

There now remains for consideration the method by which the lower part of the genital canal is opened up for the passage of the child and the resistance of the pelvic floor muscles overcome.

The Opening of the Lower Part of the Birth Canal.—The process by which the cervix is drawn up by the contraction and retraction of the longitudinal fibres of the uterine muscle continues after the cervix has been completely obliterated ; the upper segment continues to thicken as the lower segment thins, but the stretching of the lower segment is not sufficient to make up for the upward pull of the upper segment, and therefore the bladder and anterior wall are drawn up out of the way so that the bladder and urethra and the soft parts behind the symphysis are drawn up towards the abdomen. In a prolonged second stage, the bladder is drawn up so far that it comes to lie more in the abdomen than in the pelvis. The drawing up of the anterior wall leaves a free space under the pubic symphysis, through which the head will emerge. On the other hand, the head is pushed down on to the posterior vaginal wall and perineum, which it stretches and presses down in front of it. This difference in the relations of the head to the anterior and posterior walls of the birth canal is one which it is necessary to understand fully, as it has a very important bearing on the movement of internal rotation, which will be studied under the Mechanism of Labour. It is therefore worth while to explain it again in a slightly different way. The vagina has been described as a slit in the pelvic floor ; the head in its descent passes through it as if it were passing through two swinging doors, one of which is pulled forwards and the other pushed backwards. The one door, the anterior part of the cervix, the anterior vaginal wall with the bladder and urethra, is drawn up from in front of the head ; the other door, the posterior part of the cervix, the posterior vaginal wall with the rectum and perineum, is pushed down in front of the head. Hence there is in front an open space under the symphysis, towards which the most advanced point of the head will be guided, as the path of least resistance, while behind there is the stretched posterior pelvic floor, elastic and resilient, pressing the head forwards and upwards into the line of least resistance under the pubic arch. During the latter part of the second stage the pupil has the opportunity of observing something of this. Some time before the head is born, the stretching of the posterior segment will be noticed with each pain, at first far back behind the anus ; then the anus itself will be seen to be stretched and to gape and the perineum will bulge ; just before its birth the head will stretch the whole of the posterior part of the outlet at each pain, and as the pain passes off the head will be pressed back by the elastic recoil of this overstretched part of the pelvic floor. And if the finger is passed up above the back of the head behind the symphysis, it will be noticed how thin and stretched the soft parts are there, and how little soft tissue there is between the head and the pubic bones. Also, if it is necessary to pass the catheter it will be found to pass close up behind the symphysis, almost directly upwards into the bladder, which is in the abdomen. One result of this stretching of the posterior segment of the birth canal is that, in cases of obstructed or unduly protracted labour, rupture is much more likely to occur there than in the anterior segment, which is pulled up out of the way. On the other hand, if sloughing of the soft parts occurs, it is always in front from thinning and subjection to prolonged pressure between the hard head and the back of the pubes. After the head begins to distend the outlet its birth is seldom long delayed. The distension of the perineum stimulates the uterus to increased activity, strong expulsive pains follow in quick succession, and the patient is impelled to make strong bearing-down efforts with each pain. The perineum is stretched from behind forwards and from side to side,

the vulval opening gapes and from being a slit becomes first oval and then circular, but resumes its normal shape as each pain passes off. This is the last obstruction to be overcome, and when the external parts are fully dilated and its greatest diameter is born, the perineum slips back over the rest of the head. The uterus then takes a short rest, during which time retraction to make up for the escape of the head takes place, a taking up of the slack, so to speak, and then, when the uterus has shrunk tight on to the child, further contractions occur and the body is expelled round the symphysis in a direction corresponding to the curve of the canal. Very marked retraction of the uterus takes place during the escape of the body, and a hand on the abdomen can observe how the shrinking of the uterus follows the expulsion of the child. At the commencement of labour the fundus was up under the ribs; after the child is born it is well below the umbilicus. The second stage lasts one to two hours in primiparæ and from 10 minutes to half an hour in multiparæ. The greater resistance at the outlet is the chief reason for its longer duration in primiparæ.

The Third Stage.

In studying the phenomena of this stage it is best to do so under three heads. First, the separation; second, the expulsion of the placenta and membranes; and third, the control of bleeding after separation.

1. **The Separation of the Placenta and Membranes.**—After the child is born, the uterus, though not actively contracting, is felt as a firm round mass in the abdomen not reaching as high as the umbilicus. In other words, the shrinkage due to retraction is represented by a diminution in the size of the organ to about half of what it was at the commencement of labour when the fundus reached nearly to the sternum. Now that the tension on the lower uterine segment, caused by its being drawn up over the child, is no longer present, retraction takes place in it; it becomes thick and the cervix forms again at the top of the vagina. The part of the uterus in which least retraction takes place after the birth of the child is that area of the upper uterine segment to which the placenta is attached. The placenta cannot diminish in size, and its attachment to the uterine wall prevents that part retracting as much as the rest. Sometimes when the retraction of the uterus is very marked the placental attachments may be partially torn through as the child is born, but, generally speaking, this separation does not take place till later. After a rest over a varying period of from about 5 to 30 minutes, uterine contractions again come on, the uterus becoming harder and smaller. These contractions result in a marked diminution in the area of the uterine walls, so that the already diminished area of placental attachment is still more diminished, and as the placenta cannot follow this diminution, the weakest part of its attachment to the uterine wall is torn through, and this is through the line described in a previous chapter as "the postage-stamp layer," namely, the deepest part of the spongy layer of the decidua (p. 56). Possibly the separation of the placenta is assisted by blood being poured out between it and the uterine wall and so helping to strip it off. The membranes round the lower uterine segment have already been detached by the stretching which that part undergoes during the second stage of labour, and now those attached to the rest of the uterine wall become partially detached, being thrown into folds by the diminution in the size of the area to which they were formerly attached, which is no longer large enough to contain them spread out. Thus the placenta is now lying loose in the uterus, whilst the membranes are only lightly attached to the uterine wall.

2. **The Expulsion of the Placenta and Membranes.**—This is effected by further uterine contractions, which are, however, not always sufficient to cause complete expulsion; sometimes the placenta is only squeezed out of the upper uterine segment into the lower segment or into the vagina. As the steps of this part are of great practical importance they are best studied in two stages:

(1) Expulsion into the vagina; and
(2) Expulsion outside the vulva.

(1) *Expulsion into the Vagina.*—When the placenta has been attached to the side walls of the uterus, the contracting upper uterine segment may expel it down-

wards into the vagina folded up as it lay in the axis of the uterus, so that its lower border comes first; but more often it is expelled like an inverted umbrella with the smooth fœtal surface coming first. This latter way probably always occurs when the placenta is attached to the fundus, and is generally the way in which the placenta is seen to present at the vulva. As the placenta is more fully separated than the membranes, and as the uterus can get a better purchase on the large mass of the placenta than on the thin papery membranes, it is commonly expelled from the uterus through the hole in the bag of membranes through which the child escaped, and with the fœtal surface outermost, the membranes following afterwards, their final attachments to the uterus being separated by their being dragged out by the weight of the placenta. In one or other of these ways the placenta is expelled from the uterus by the contractions which succeed those which have effected its separa-

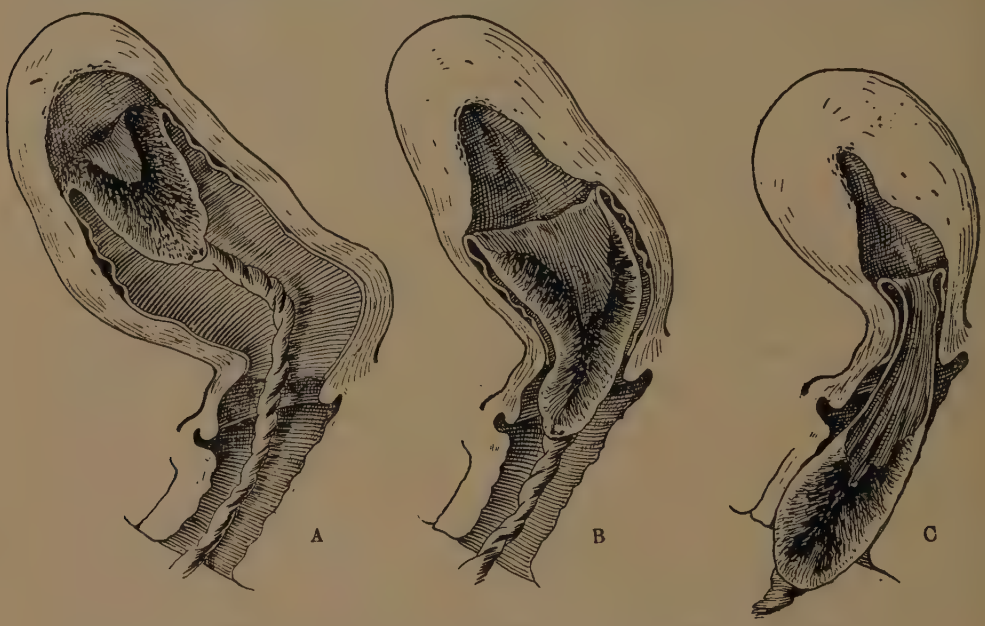

FIG. 48.—SCHEME OF SEPARATION AND EXPULSION OF PLACENTA AND MEMBRANES.

A. Placenta partially separated: membranes thrown into folds.
B. Complete separation and partial extrusion of placenta. The placenta is coming out like an inverted umbrella and dragging after it the loose and partially separated membranes. The placenta is in the lower uterine segment and just commencing to pass through the external os; retraction is well marked in the upper segment of the uterus.
C. The placenta is at the vulva; the membranes are completely separated from the upper uterine segment and are very loosely attached to the lower segment. The hard, round, firmly retracted upper uterine segment is empty. The placenta is being expelled like an inverted umbrella with the membranes streaming after it.

tion, and lies in the vagina or lower uterine segment with the firmly contracted and retracted upper uterine segment riding on the top of it. As will be seen when the management of the third stage is described, this occurrence can be recognized by abdominal palpation and is important in conducting this part of a labour.

(2) *Expulsion outside the Vulva.*—As the placenta has now escaped from the grasp of the active part of the uterus, it is evident that its complete delivery must depend on the auxiliary muscles, *i.e.* on the patient's bearing-down efforts. The patient takes a deep breath and holds it; she then contracts her abdominal muscles and presses downwards as hard as she can; this pushes the uterus down on the placenta and so expresses it out of the vagina. The smooth amniotic surface comes first, the membranes streaming after it, together with a certain amount of blood which has been effused behind the placenta, and thus the third stage is over. If strong bearing-down efforts are made with the third stage contractions the placenta may be expelled outside the vulva at once.

3. **The Means by which Hæmorrhage is checked.**—When the placenta is

separated from its site of attachment, the large vessels which have brought the maternal blood to and from the placenta to circulate among the chorionic villi are torn across, and if there were not some means of checking the bleeding from their open mouths, the mother would die of hæmorrhage. When nature's method of controlling this fails, the extremely dangerous complication known as postpartum hæmorrhage (p. 216) occurs, and as the prevention and treatment of this condition depend on assisting and bringing about the natural means of control, it is most important that the pupil should have a very clear understanding of them. For this we require to consider first the anatomical arrangement of the vessels in the uterine wall, and secondly, the effect on them of the contraction and retraction of the uterus. The course of the vessels in the uterine wall is not straight or direct. The arteries pass from the main uterine artery in corkscrew-like spirals, and the veins take a zigzag course back to the uterine veins. Round many of the larger vessels in the wall the uterine muscle forms rings and bands of interlacing fibres, which, when they contract, will compress the vessels and check the circulation through them (Fig. 45 B). Not only these special fibres but the whole muscular wall of the uterus when it contracts will compress these tortuous vessels, and squeeze the blood out of the uterus and prevent blood getting into it. The effect of a contraction in squeezing the blood out of the uterus is often well seen at the operation of Cæsarean section, when the child is cut out of the uterus because the birth of a living child is impossible by the natural passages. When the abdomen is opened and the relaxed uterus is seen, it is of a bright pink colour, but should a contraction come on, it at once becomes pale and bloodless. While the uterine wall is being cut it often bleeds in an alarming way, but as soon as the child is removed and the uterine wall shrinks down, the bleeding from the cut surface is greatly diminished, and when once the uterus is firmly retracted, it practically ceases. If the contraction and retraction of the uterine muscle can control the bleeding from a cut right through its wall and big enough to allow the child to be extracted through it, it will be clear that the same process will just as effectually control hæmorrhage from the placental area. As the result of the squeeze of the contracted and retracted muscle on the vessels passing through the uterine wall, the circulation becomes so slowed that clotting occurs in the larger veins of the placental area and this acts as an additional preventive of hæmorrhage. It must be remembered that this clotting is a later event and is not of importance in the immediate checking of bleeding after labour ; it will not take place till the flow of blood is slowed, and if the pressure of the contracting uterine wall was removed by a marked relaxation sufficient to allow the blood flow to be re-established, the loose clots would be easily washed out. Some hours after labour, when the clotting in the veins is fairly general and when the clots have had time to become firm, then they have an important influence, but the pupil will easily recognize from this that the production of clotting is of no value as a method of treatment in an urgent case of bleeding after labour.

The third stage lasts 10 to 30 minutes.

CHAPTER X.

THE MECHANISM OF LABOUR.

The Fœtal Skull.

Before considering the mechanism of labour it is necessary to describe the form and measurements of the fœtal head as it presents in normal labours.

The head is divided into the *vault of the cranium, i.e.* the part between the forehead in front and the nape of the neck behind, the *base of the skull, i.e.* the under part of the brain-pan, and *the face.*

The vault, which is covered by the scalp, is made up of four bones separated by four sutures. There are the two large *parietal* bones on each side, on which are the well-marked prominences, called the parietal eminences, marking the widest part of the head.

In front is the *frontal* or forehead bone, and behind, fitting in between the parietal bones, is the *occipital* bone, with that very marked prominence just above the nape of the neck, the occipital protuberance or occiput. The occiput can be felt as a marked bony projection just where the skin of the neck joins the scalp. These bones at birth are not fully formed of hard bone but are partly membranous, and are, therefore, thin and pliable and can undergo a certain amount of bending. Still further alteration in the shape of the vault during labour is rendered possible by the bones being separated at their edges by thin lines of non-bony membrane—the *sutures,* with wider spaces at intervals, the *fontanelles.*

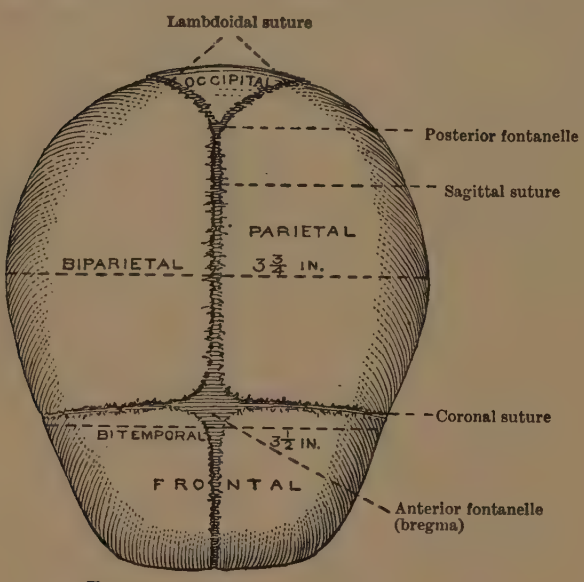

Fig. 49.—The Fœtal Skull from Above.

The sutures which join these bones together are :

The **sagittal suture,** running along the very top of the skull between the two parietal bones. It extends from the occipital bone behind to the lozenge-shaped anterior fontanelle in front, and is continued down the middle of the forehead as the frontal suture between the two halves of the frontal bone.

The **coronal suture** runs across the crown of the head between the frontal bone and the parietal bones, and crosses the sagittal suture at the anterior fontanelle.

The **lambdoidal suture** separates the parietal bones from the occipital bone.

The fontanelles are the wider membranous intervals between the bones. There are several of these, but only two are of sufficient importance in midwifery to deserve description.

The **anterior fontanelle,** or **bregma,** is the diamond-shaped space in the middle line between the two parietal bones and the two frontal bones. Four sutures open into its corners, namely, the sagittal behind the frontal in front and the right

and left halves of the coronal suture on each side. It forms quite a wide space at birth and does not close till the child is more than a year old. It feels a little depressed below the general level of the skull, and through it arterial pulsation can be felt from the brain cavity.

The **posterior fontanelle** is formed where the sagittal suture runs into the lambdoidal. There is scarcely any space but only a slight depression. Three sutures run into it, the sagittal and the right and left halves of the lambdoidal.

The **vertex** is the top of the head from the forehead to the occiput : the highest point of the head is a little in front of the posterior fontanelle.

The points noted in connection with these fontanelles are of great importance in recognizing them on examination. While the vault of the skull is compressible and will undergo moulding, the base of the skull and the face undergo no such change, as the bones composing them are more completely ossified and more firmly united at birth.

The chief diameters of the skull and their measurements must be known in order to follow the mechanism of labour. They are :

1. The **mento-vertical,** the maximum diameter of the skull, is measured from

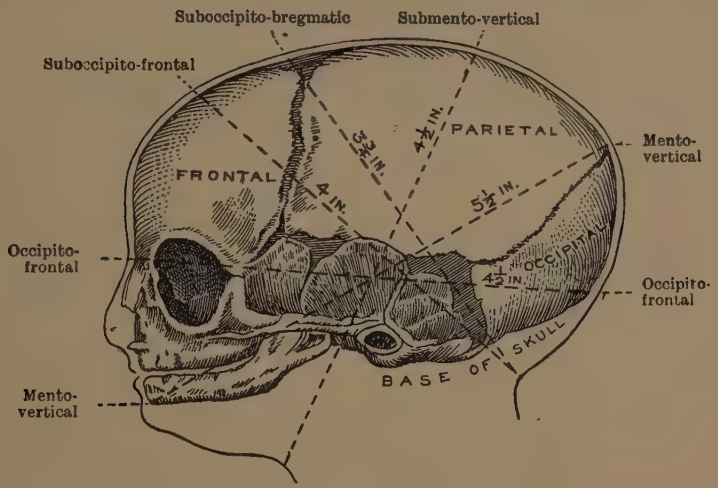

FIG. 50.—THE FŒTAL SKULL FROM THE SIDE.

the point of the chin to the sagittal suture at the highest point of the vertex, and measures $5\frac{1}{2}$ inches.

2. The **occipito-frontal,** from the occipital protuberance to the root of the nose, measures $4\frac{1}{2}$ inches.

3. The **suboccipito-frontal,** from the nape of the neck to the front of the bregma, measures 4 inches.

4. The **suboccipito-bregmatic,** from the nape of the neck to the centre of the bregma, measures $3\frac{3}{4}$ inches.

5. The **submento-vertical,** from the neck below the chin to the sagittal suture at the top of the vertex, measures $4\frac{1}{2}$ inches.

The transverse diameters are :

1. The **biparietal,** between the two parietal eminences and therefore the widest part of the head, measuring $3\frac{3}{4}$ inches.

2. The **bitemporal,** between the temples, measuring $3\frac{1}{2}$ inches.

3. The **bimastoid,** the distance between the bones at the back of the ears, measuring 3 inches.

Circumference of the Fœtal Head.—The smallest circumference of the head is that taken round the suboccipito-bregmatic diameter ; it measures about 11 inches ; the largest circumference is that measured round the head from the chin to the occiput and is over 14 inches. The circumference round the occipito-frontal diameter is slightly less than 14 inches.

If the skull is turned upside down and the base examined, the oval opening,

the **foramen magnum,** will be seen, which carries the spinal cord into the brain. On each side of the foramen magnum are the condyles, or joint surfaces, which articulate with the first cervical vertebra, the atlas (so called because it supports the head, as Atlas supported heaven). The condyles are the " rockers " on which the head moves in nodding, and the joint formed between them and the atlas is the occipito-atlantoid joint. Notice that it is not centrally placed, but is nearer the occipital end of the skull. The next cervical vertebra is termed the axis, because it forms the axis or pivot on which the head rotates from side to side. In front of the foramen magnum are the jaws ; the hard palate with the posterior opening of the nasal cavity may be easily recognized. Cleft-palate (p. 110) is due to the non-union of the two halves of the hard palate.

THE MECHANISM OF LABOUR

In the mechanism of labour two factors, the passenger and the passages, and the changes that occur in their relations to one another during the progress of the labour, are considered : these changes are due to the fact that the child must accommodate itself to the varying diameters and curves of the parturient canal so as to offer the minimum of difficulty to its passage through them. These movements of the child in relation to the birth canal are described as the " Mechanism of Labour," and as they will naturally differ according to the presentation and lie of the child, there are certain definitions used to designate the various positions the child may take, which must first of all be defined.

By the *attitude* of the fœtus is meant the relation which the different parts of its body have to one another. It is one of general flexion : the head is bent on the chest with the point of the chin touching the breast-bone ; the back is bent so as to form a rounded surface ; the thighs are bent on the abdomen and the legs on the thighs ; the arms are bent and folded on the chest. This gives an egg-like or ovoid shape to the fœtus, which corresponds to the ovoid cavity of the uterus.

The *lie* of the fœtus is a term used to describe the relation of the fœtal ovoid to the uterine ovoid, *i.e.* of the long axis of the fœtus to the long axis of the uterus. Lies are of two kinds. The common one is the *longitudinal* lie, when the long axis of the fœtal ovoid is in the long axis of the uterine ovoid, and of this there may be two kinds—(1) the common one with the child's head below (cephalic), (2) the rarer one with the buttocks below and the head upwards (pelvic). The much rarer lie is the *transverse* or *oblique* lie, when the long axis of the fœtal ovoid does not correspond with the long axis of the uterine ovoid. These are the " cross births," so called because the fœtus lies across the uterus. Commonly the lie is oblique (p. 180).

By *presentation* is meant that part of the fœtus which lies lowest in the axis of the birth canal and is the first part to enter the brim. It is found to " present " when an examination is made. In 96 per cent. of all labours the vertex or top of the head presents ; other presentations, such as face, breech, shoulder, etc., make up the remaining 4 per cent. The great preponderance of head presentations is due to the fœtal ovoid fitting into the uterus best with the head below and breech above, or, some would have it, because the head is the heaviest part of the fœtus ; on the other hand, the least convenient fit is with the fœtal axis across the uterine axis, and it is therefore an uncommon one.

By *position* of the fœtus is meant the relation of the child's back to the front or back of the mother, or of the presenting part to the pelvis of the mother. If the child's back is in front it is a dorso-anterior, if it is to the mother's back it is a dorso-posterior position, or some point on the presenting part is taken as a " denominator," and its situation in the pelvis used to denominate the various positions of that presentation. Thus the occiput is taken as denominator in vertex presentations, the chin in face presentations, and the sacrum in breech presentations, and the various situations of the occiput, chin, and sacrum, as the case may be, in relation to the mother's pelvis are used to describe the position.

In this chapter we deal with the movements which are necessary in order that a child may be born naturally when it presents by the vertex. As these mechanisms

are by far the most frequently met with, and as they are the first to be described, it will be best to study them in greater detail than in the rarer ones. But it should be understood that the principles which hold good in vertex mechanisms will apply also to those of other presentations, and that unless they are mastered it will not be possible to follow those described later. The advice given to the pupil when studying the anatomy of the pelvis and fœtal skull holds good also in studying mechanisms, They must be worked out by the pupil with the pelvis, fœtal skull, and dummy fœtus. and not merely studied from diagrams. Further, all of them must be checked by observation during labour.

There are four positions described in vertex presentations, as it is found that the head almost always enters the pelvis with its long diameter in one of the two oblique diameters of the pelvis. As the occiput is the point on the vertex which is used to denominate these positions, they may be described as follows :

First Position.—Head in right oblique diameter
Second Position.—Head in left oblique diameter
} Occiput-anterior and < to left—L.O.A. / to right—R.O.A.

Third Position.—Head in right oblique diameter
Fourth Position.—Head in left oblique diameter
} Occiput-posterior and < to right—R.O.P. / to left—L.O.P.

The letters at the end are the abbreviations which are used to designate the positions—

L.O.A. means . . . . . Left occipito-anterior.
R.O.P. means . . . . . Right occipito-posterior, and so on.

If the fœtal skull is placed in the brim of the pelvis (which should be held with the pubes to the front so that its right corresponds to the pupil's right) so that its long axis as represented by the sagittal suture lies in the right oblique diameter with the occiput pointing to the front of the pelvis, it will be in the first position of the vertex. Now turn the head round the pelvis in the direction of the hands of a watch until it is again in the oblique diameter ; though the occiput is still to the front it is now pointing to the right and the sagittal suture is in the left oblique diameter, it is in the second position. Continue to turn the head in the direction of the hands of a watch ; when the occiput is opposite the right sacro-iliac joint, the head is in the third position, and a quarter-turn in the same direction will bring it opposite the left sacro-iliac joint, and into the fourth position. Of these positions the first is by far the most frequent, occurring in nearly three-quarters of all vertex cases ; the second and third come next, whilst the fourth is the least common. It will be seen later, however, when the mechanism is studied, that in the third and fourth positions, in which the occiput is posterior, the head moves in its descent so as to bring the occiput to the front, therefore in the course of the labour they become converted into a second and first respectively. Hence many cases of occipito-posterior positions will be recorded as occipito-anterior if unrecognized early or if examination is not made till late in the labour. Thus posterior positions may be more common than the figures show.

The movements we are about to describe take place almost entirely during the second stage of labour, during the passage of the head through the pelvic cavity, and therefore whilst they are taking place there is all the time a steady descent of the head.

The mechanism of the first position, L.O.A., will be taken first, as it is by far the commonest ; afterwards the points in which the others differ from it will be studied.

Mechanism in L.O.A. Positions.

The movements which the child undergoes during its descent through the pelvis are usually described as—

Flexion
Internal Rotation
Extension
External Rotation (with Restitution)
} of the head.
Expulsion of the trunk.

The points especially to be noted in regard to them are: the nature of the movement, the way it is brought about, and finally the mechanical advantage which it gives.

Flexion.—As the head enters the pelvis with the occiput pointing to the left foramen ovale it is, with the rest of the child, flexed, *i.e.* bent so that the chin is pressed closely on to the chest. This means that the occiput is lower in the pelvis than the forehead. Therefore place the head in the pelvis in the first position and tilt it so that the posterior fontanelle is much lower than the anterior. The head will then be flexed. Now as this is the attitude of the head before labour begins, it may be said that it is not a movement of labour. It is called a movement, however, because in cases in which the head fits the pelvis at all tightly the flexion is increased during the passage of the head through the resistance of the pelvic cavity. The reason of this increased flexion is not difficult to understand; it depends on the shape of the head and on the way it is attached to the spine. The steep slope of the head is the occipital end; the frontal slope is much flatter. The steep end goes down more easily. If the head was quite round and was pushed down exactly from its centre there would be no reason why one end should go down before the other. But the head is more or less of an ovoid shape, and it is joined to the spine much nearer its occipital end than its frontal end (p. 110). Therefore the resistance of the genital passage acts much more on the end with the longer leverage, *i.e.* the frontal end, and so keeps back the forehead more than the occiput, *i.e.* increases flexion. This increased flexion begins as soon as the head begins to descend and continues till it reaches the outlet. The effect of complete flexion is to substitute a smaller diameter of the fœtal head, the suboccipito-bregmatic, for a larger one, the occipito-frontal. As the one measures $3\frac{3}{4}$ inches and the other $4\frac{1}{2}$ inches, there is a mechanical gain of $\frac{3}{4}$ inch. Another advantage is obtained in that flexion brings the occiput first on to the pelvic floor, and thus, as will be explained later, causes it to be rotated forwards to the pubes—in fact, facilitates the next movement of the head.

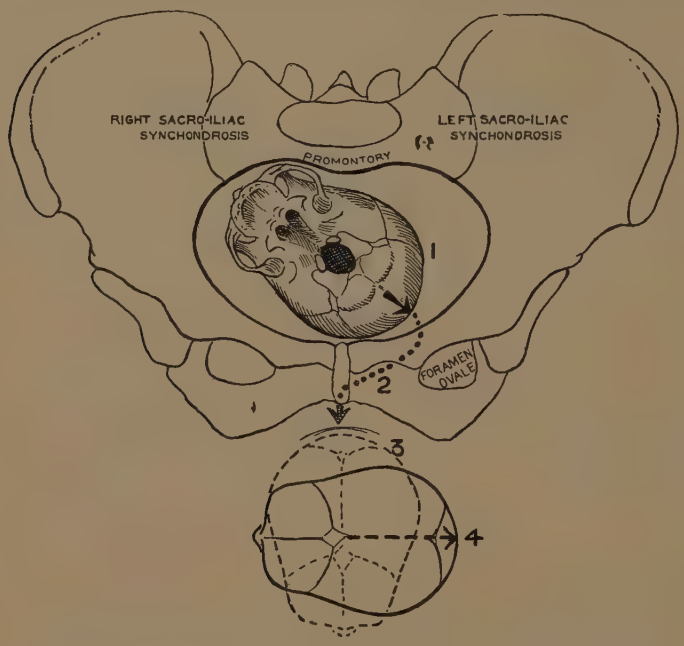

FIG. 51.—DIAGRAM OF THE MECHANISM IN THE FIRST VERTEX POSITION (L.O.A.).[1]

The skull is shown held in the pelvic brim in the right oblique diameter, with the occiput forwards and pointing to the left foramen ovale. 1. With the first movement, *flexion*, the occiput, marked by the arrow, goes down in advance of the forehead. This brings the occiput first on the pelvic floor, and the next movement, *internal rotation* through $\frac{1}{8}$th of a circle, indicated by the dotted line 2, follows, and by it the head is brought into the antero-posterior diameter at the outlet with the occiput under the pubic arch at the point marked by the arrow. The occiput having escaped from under the pubic arch, *extension* takes place, the head assuming the position 3, shown by the broken outline of the skull. The final movement, *external rotation* through $\frac{3}{8}$ths of a circle, by which the occiput turns directly to the left, is shown by the skull in outline marked 4.

Internal Rotation.—In this movement the head turns from the right oblique in the cavity of the pelvis to the antero-posterior diameter at the outlet; the occiput

[1] The diagrams are intended to assist the pupil in, and not as a substitute for, working out the mechanisms with the skull and pelvis.

moves from opposite the left foramen ovale to under the pubic symphysis, while the forehead slips into the sacral hollow. Internal rotation takes place fairly low down in the pelvic cavity, sometimes not till the head has passed the level of the ischial spines or is on the perineum. This is because it is brought about by the elastic recoil of the muscular and ligamentary structures of the pelvic floor, and therefore cannot occur till the head has come low enough down to be influenced by them. As it is a very important movement, and as internal rotation occurs in all mechanisms, it is necessary to spend a little time in explaining it fully. It cannot be due to the shape of the head, as it occurs in other presentations than those of the vertex, such as the face and breech, nor can it be due to the influence of the inclined surfaces of the ischial spines, as it occurs when the occiput is posterior as well as anterior. It is due to the resilient pelvic floor pushing forward in the direction of least resistance, *i.e.* towards the pubic arch, that part of the presenting part which first comes on to it. In this case it is the occiput. As will be seen later, this holds good in other presentations—for the chin in face presentations, the anterior hip in breech presentations, the point of the shoulder in shoulder presentations, and so on. In order to understand properly the causation of internal rotation, it is necessary to recall what has been said in regard to the pelvic floor. That structure was described as sloping down from the sacrum forwards to the perineum, and from the lateral walls of the pelvis down to the

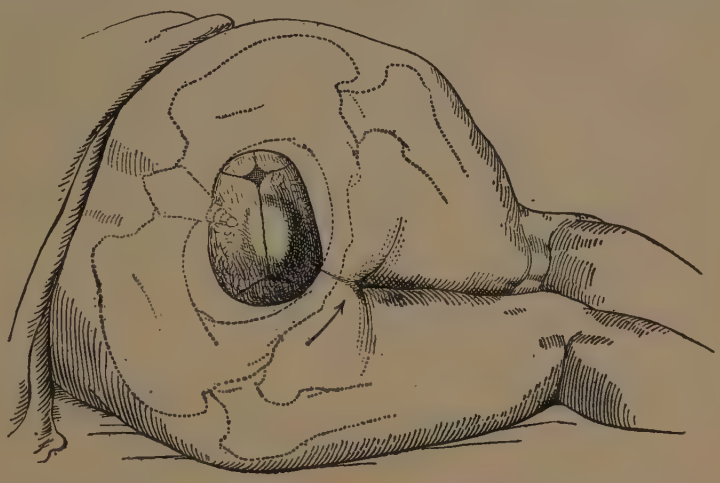

FIG. 52.—THE FIRST VERTEX POSITION (L.O.A.) BEFORE ROTATION, SHOWING THE SUTURES AND FONTANELLES AS FELT ON VAGINAL EXAMINATION WITH THE PATIENT LYING ON HER LEFT SIDE.

The head has entered the pelvis with the occiput pointing to the left; the arrow shows the direction in which rotation will occur. With good flexion the occiput will be low down and the anterior fontanelle high up. The shaded area represents the caput succedaneum which is formed on the right parietal bone (p. 121).

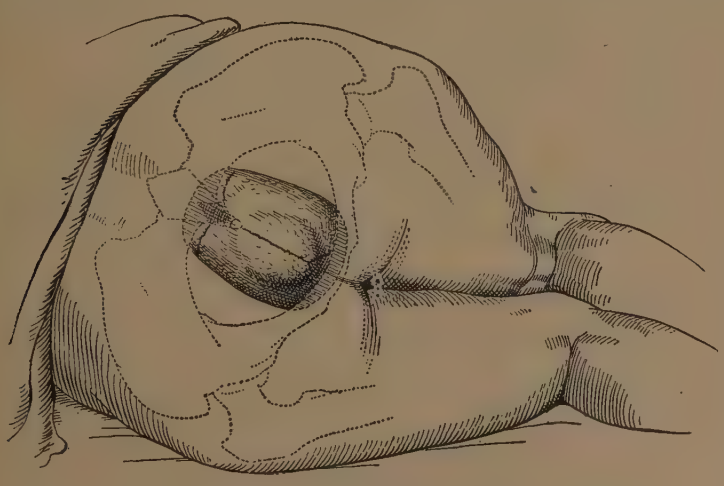

FIG. 53.—THE FIRST VERTEX POSITION, SHOWING THE HEAD AFTER INTERNAL ROTATION HAS OCCURRED.

The sagittal suture is now in the antero-posterior diameter of the outlet with the posterior fontanelle in front. The caput succedaneum is nearly over the posterior fontanelle (p. 121).

middle line (p. 48). Also, as the result of uterine retraction and contraction, the structures anterior to the vagina are drawn up (p. 104). This leaves the sloping resilient pelvic floor behind, whilst in front there is an open space under the pubic arch where the anterior section of the pelvic floor has been drawn up out of the way. Now with each pain the head will be pushed down firmly on to the posterior pelvic floor and will stretch it; as the pain passes off, the pelvic floor will, like a sheet of stretched elastic, press back on the head. As this floor is gutter-shaped and slopes downwards, it will, as each pain passes off, exercise a recoil action on the first part of the head (the occiput) to come in contact with it, and will guide it into the middle line and so under the pubic arch. If the pupil has any difficulty in understanding this recoil action, she must think of what she sees when the head distends the perineum; there with each pain she will see the lowest part of the pelvic floor stretch, and, as the pain passes off, the resilient floor recoil and push back the head. This same action has been taking place higher up in the pelvic cavity, and, by the arrangement of the pelvic floor, has caused the occiput to rotate forwards as described. The result of the movement is to bring the long diameter of the head into the longest diameter at the outlet, the antero-posterior.

To make this movement clear, let the pupil hold a notebook half open with its pages sloping slightly away from her. The half-open book represents the sloping gutter formed by the posterior segment of the pelvic floor. Now let her place a

Fig. 54.—Diagram of a Book and Pencil arranged to explain the Action of the Pelvic Floor in producing Internal Rotation.

a shows the pencil representing the long axis of the head in the oblique diameter with the point lower than the blunt end, the book representing the sloping gutter of the pelvic floor; *b* shows the elastic recoil of the pelvic floor after it has been stretched by a pain pressing the pencil into its own long axis; *d* and *f* show further stages of the same process, *e* and *g* showing the effect produced. In *h* the pencil is in the antero-posterior diameter.

pencil obliquely between the two halves of the book so that the point is somewhat lower than the blunt end (see Fig. 54, *a*). The pencil will represent the long axis of the head sliding down the gutter with its point, the occiput, in advance (=flexion). Close the book somewhat till it presses on the two ends of the pencil. This represents the elastic recoil of the pelvic floor after it has been stretched by a pain; and its pressure on the pencil, the pressure of the pelvic floor on the head (Fig. 54, *b*). The effect will be gradually to squeeze the pencil into the line of the fold of the book with its point lowest (Fig. 54, *b* to *h*), *i.e.* it illustrates how the long axis of the head is pressed from the oblique into the antero-posterior diameter (=internal rotation). Again, if the pencil is placed between the pages with its blunt end (=the forehead) lower and the same process repeated, it will result in the same change in the long axis of the pencil, but this time the blunt end will appear below the lower margin of the book, illustrating how that point of the presenting part which first strikes the pelvic floor is rotated forwards (in this case the backward rotation of the occiput in unreduced occipito-posterior positions, p. 120).

To make the illustration more correct it would be necessary to substitute for the pencil an ovoid body like an egg with a decided blunt end and a pointed end, and to have, in addition to the lateral squeeze of the two halves of the partially closed book, a forward pressure from the fold in the middle. That would show not only how the long axis of the presenting part is pressed from the oblique into the

antero-posterior diameter, but also how the lowest point is pushed forwards to the open space under the pubic arch.

Extension. — The previous movement has brought the occiput under the pubic arch and the forehead and face into the sacral hollow. If there were no soft parts at the outlet, the head might be born without the flexion on the chest being undone. But as the uterine and auxiliary muscles drive the head down on to the pelvic floor and perineum, the perineum in turn pushes each part of the head as it escapes, upwards and forwards. The result is that as the forehead descends it is pushed upwards and forwards, and as the face escapes it also is pushed upwards and forwards, so that as the head escapes over the perineum its flexion on the chest is undone and the opposite condition of extension produced. The movement of extension, then, means that the nape of the neck becomes fixed under the pubic arch, and, pivoting round this fixed point, the forehead, nose, and chin slip out in turn over the perineum. It occurs as soon as the nape of the neck is fixed under the pubic arch, *i.e.* when the occiput is born, and results in the head being thrown forwards so as to avoid the perineum, and is always best seen in primiparæ or multiparæ with an undamaged perineum. The stronger the perineum the more does the occiput rise up in front of the symphysis pubis.

External Rotation with Restitution. — The external rotation really consists of two movements, first restitution and then external rotation. Restitution is due to the head, as soon as it escapes, being free to assume its usual relation to the shoulders previously upset by the head being slightly twisted on the shoulders during the movement of internal rotation; the shoulders do not follow completely this movement, and therefore as soon as the head is free the undoing of this twist, or the restitution of the occiput to the position it originally occupied, occurs, sometimes with a little jerk. External rotation, though described as a movement of the head, is really due to a movement of the unborn part of the body in which the head naturally partakes. The long axis of the shoulders, being at right angles to the long axis of the head, comes down in the oblique diameter, opposite to that which the head has taken, *i.e.* in the left oblique. The right shoulder of the child is therefore opposite the right foramen ovale and its left opposite the left sacro-iliac joint. The next pains after the birth of the head result in the right shoulder being rotated underneath the pubic arch while the left goes into the hollow of the sacrum. The head, in order to follow this movement, turns so that the occiput looks to the side to which it originally pointed, *i.e.* to the mother's left, and this movement is therefore called the external rotation of the head, though it is really an internal rotation of the shoulders. As a result, the long axis of the shoulders passes into the longest diameter at the outlet.

Expulsion of the Trunk.—After the shoulders have rotated, the anterior one, *i.e.* the right, engages under the symphysis, whilst the posterior, the left, escapes over the perineum, being pushed forwards for the same reason that the face was pushed forwards in extension of the head. The rest of the body is then born, flexed slightly sideways following the curve of the genital canal.

In studying the movements of extension and external rotation it is essential that a dolly or dummy fœtus be used, otherwise the movements of the head in relation to the trunk and the movement of the shoulders cannot be followed.

The mechanism of the L.O.A. cases has been described fully, so that it will now be necessary only to point the differences in that of the other positions.

Mechanism in R.O.A. Positions.

This is exactly the same as in the first position, except that the head enters the pelvis in the left oblique diameter, and that internal rotation takes place from the right foramen ovale to the pubic arch, and after extension the occiput turns to the mother's right thigh, *i.e.* to the side to which it originally pointed, while the left shoulder, which is anterior, engages under the pubic arch, and the right glides over the perineum.

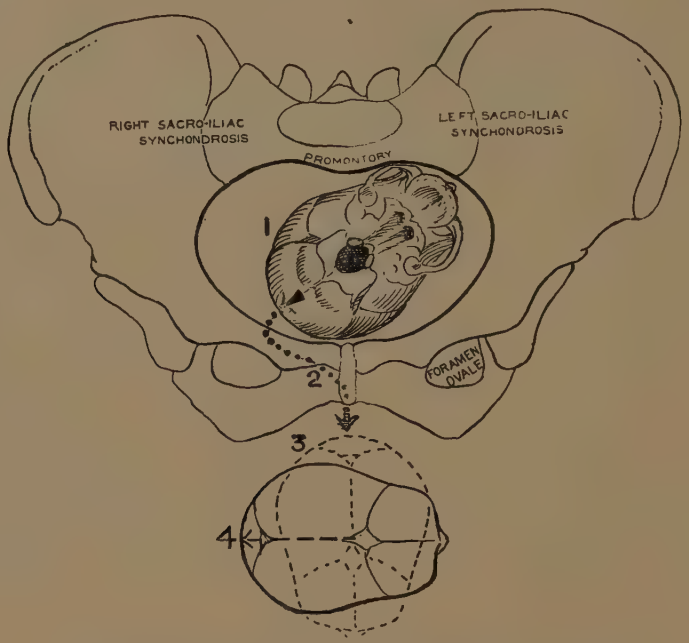

Fig. 55.—Diagram of the R.O.A. Mechanism (Second Position of the Vertex).

1. Head in the left oblique diameter, with the occiput (marked by a black arrow forwards). The occiput goes down in advance = *flexion*.
2. *Internal rotation* through $\frac{1}{8}$th of a circle, by which the occiput turns during its descent through the pelvis from opposite the right foramen ovale to under the symphysis, is shown by the dotted line.
3. *Extension* shown by the skull in broken outline.
4. *External rotation* through $\frac{3}{8}$ths of a circle, by which the occiput turns to the right, is shown by the skull in outline.

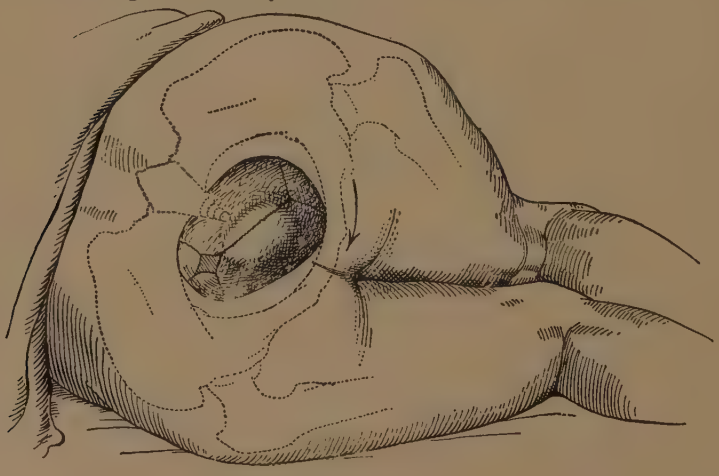

Fig. 56.—Second Vertex Position (R.O.A.) before Rotation.

Vaginal examination with the patient on the left side. The head is in the left oblique diameter, with the occiput forwards and to the right; the arrow shows that internal rotation will bring the occiput under the pubic arch. The caput has formed on the anterior (*i.e.* the left) parietal bone (p. 121).

Mechanism in R.O.P. Positions.

The head enters the pelvis in the right oblique diameter, the occiput being opposite the right sacro-iliac joint. Flexion takes place as before, and the occiput is the first part of the head to meet the resilient pelvic floor. This results in a long internal rotation taking place, the occiput being pushed round the right side of the pelvis until it reaches the pubic arch, when the mechanism is exactly as in R.O.A. positions. During this long internal rotation, the head passes from the right oblique diameter into the transverse, and from it into the left oblique diameter, and then into the antero-posterior at the outlet; this rotation is therefore three times as long as in an occipito-anterior position.

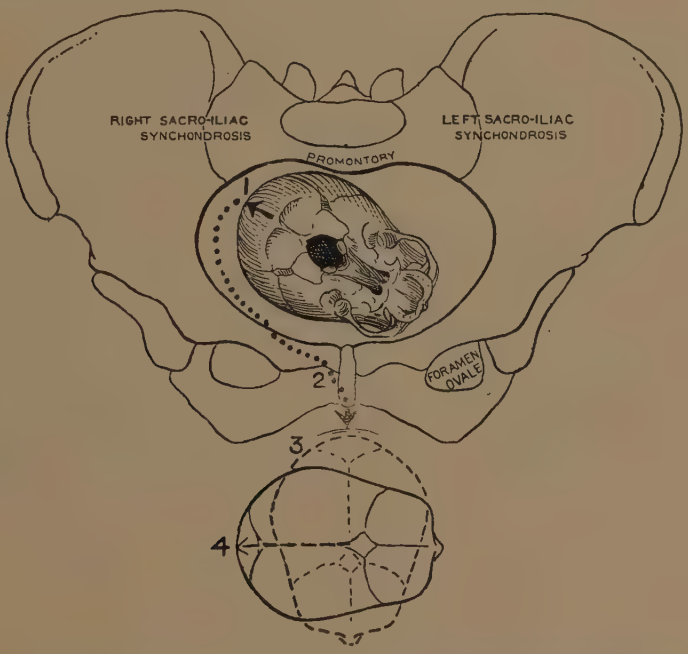

Fig. 57.—Diagram of the R.O.P. Mechanism (Third Position).

1. The head is in the right oblique diameter with the occiput backwards. The occiput goes down in advance = *flexion*.
2. The long *internal rotation* through ⅜ths of a circle, by which the occiput rotates from opposite the right sacro-iliac synchondrosis to under the symphysis, is shown by the dotted line.
3. *Extension* is shown by the skull in broken outline.
4. *Internal rotation* through ⅜ths of a circle, the occiput turning to the right, is shown by the skull in outline.

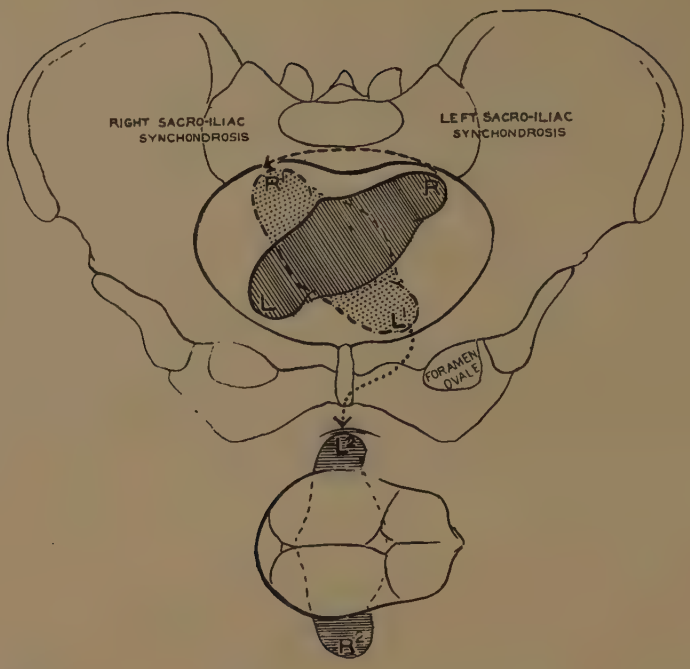

FIG. 58.—DIAGRAM TO SHOW THE ROTATION OF THE SHOULDERS IN THE R.O.P. POSITION.

The shoulders enter the pelvis in the opposite oblique diameter to the head—*i.e.* the left oblique—as shown by the shaded outline. The left shoulder, L, is in front; the right, R, behind. Whilst the head rotates $\frac{3}{8}$ths of a circle, the shoulders only rotate through $\frac{3}{8}$ths—*i.e.* from the left oblique into the right oblique. This rotation is shown by the dotted arrow over the sacral promontory, and the new position of the shoulders by the dotted outline. The right shoulder, R^1, is now opposite the right sacro-iliac synchondrosis, and the left, L^1, opposite the left foramen ovale. After the escape of the head at the vulva, the occiput makes $\frac{1}{8}$th of a circle turn to the right to regain its usual position in regard to the shoulders. Then the left shoulder, L^1, does an internal rotation of $\frac{1}{4}$th of a circle—shown by the dotted line over the front of the pubes—to under the symphysis, L^2, while the right shoulder, R^2, sweeps over the perineum. During this internal rotation of the shoulders from the right oblique into the antero-posterior diameter at the outlet, the head turns a further $\frac{1}{4}$th of a circle, thus making a complete external rotation of $\frac{3}{8}$ths of a circle. The final position of the head and shoulders is shown in outline below the symphysis.

Note to Pupil.—This diagram can only be understood if followed by putting the dummy fœtus through the pelvis and noting the movements of the head and shoulders as described.

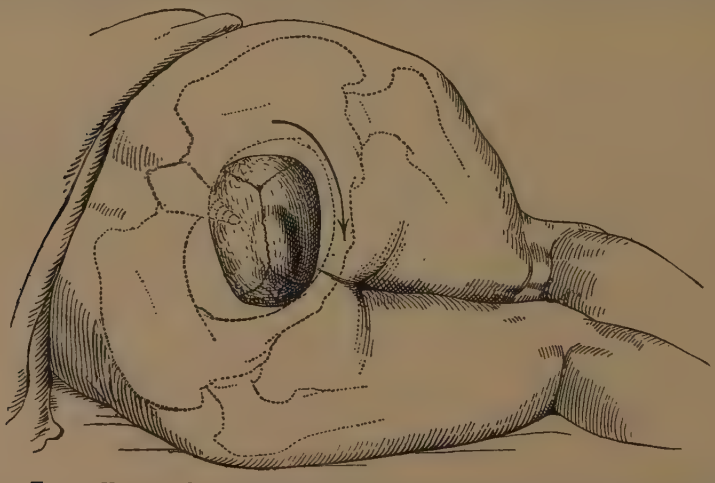

FIG. 59.—THIRD VERTEX POSITION (R.O.P.) BEFORE ROTATION, SHOWING THE FINDINGS ON VAGINAL EXAMINATION.

Note the relations of the sutures and fontanelles to the maternal pelvis. The arrow indicates the long rotation of the occiput from opposite the right sacro-iliac synchondrosis to under the pubic arch. The caput has formed over the left parietal bone and further forward than in the first and second positions (p. 121).

Mechanism in L.O.P. Positions.

This is exactly similar to the R.O.P., except that in the long internal rotation the occiput rotates round the left side of the pelvis, so that by the time it reaches

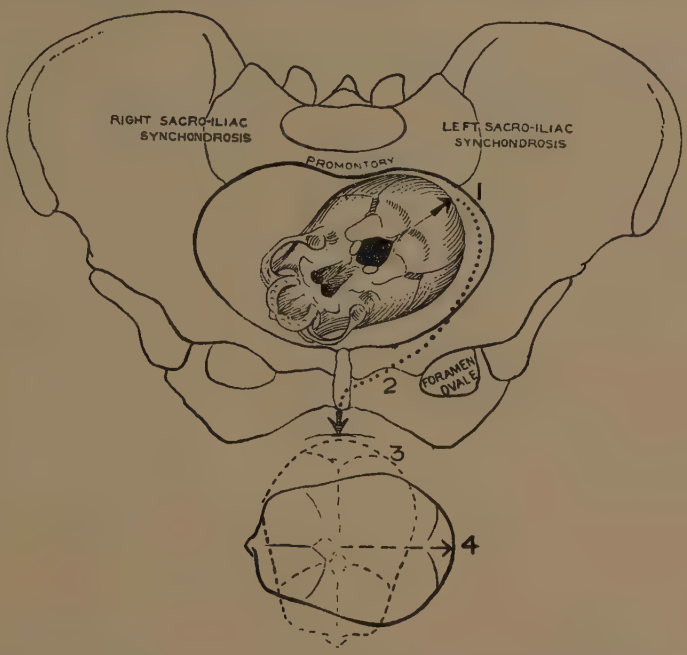

Fig. 60.—Diagram of the L.O.P. Mechanism (Fourth Position).

1. The head is in the left oblique diameter with the occiput backwards. The occiput goes down in advance = *flexion*.
2. The long *internal rotation* through ⅜ths of a circle by which the occiput rotates from opposite the left sacro-iliac synchondrosis to under the symphysis is shown by the dotted line.
3. *Extension* is shown by the skull in broken outline.
4. *External rotation* through ⅜ths of a circle, the occiput turning to the left, is shown by the skull in outline.

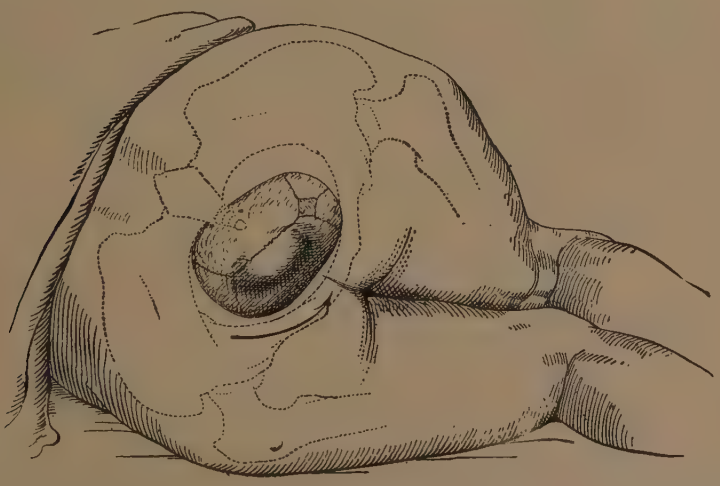

Fig. 61.—Fourth Vertex Position (L.O.P.) before Rotation, showing Findings on Vaginal Examination.

This is exactly similar to Fig. 59, except that the occiput is opposite the left sacro-iliac synchondrosis instead of the right, and that the caput is on the right parietal bone (p. 121). The arrow as before indicates the long internal rotation round the left side of the pelvis.

the left foramen ovale it becomes converted into a first position, and the rest of the mechanism is as described for that.

Abnormal Occipito-posterior Cases.—When the occiput is posterior, flexion may be incomplete. Various reasons have been given for this. If the rounded flexed back of the fœtus is towards the mother's back, the tendency will be for it to be straightened, *i.e.* extended, and this will be more marked the stronger the abdominal muscles, as they will press the back the more firmly against the convex lumbar curve of the maternal spine. Extension of the trunk will result in extension of the head, for the chest begins to leave the chin, and therefore the chin to leave the chest. Also, as there is less resistance to that part of the head that is in the front of the pelvis, the increased flexion produced by the keeping back of the forehead (p. 112) is diminished when the forehead is in front and the occiput behind, and there is thus a greater tendency for the forehead to descend before the occiput, *i.e.* for extension to occur. Another factor helping to produce extension is that with the occiput posterior, the widest diameter of the head, the biparietal, lies in a narrower pelvic diameter, namely, one behind the oblique, whereas with the occiput anterior

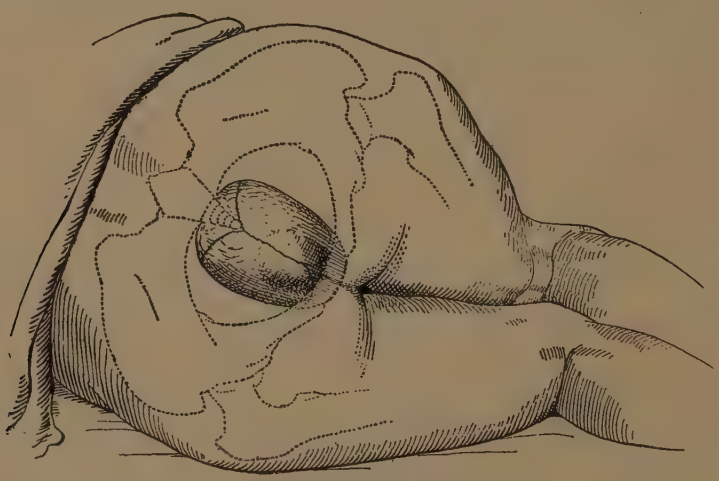

FIG. 62.—PERSISTENT OCCIPITO-POSTERIOR.

The diagram shows the findings on vaginal examination after backward rotation of the occiput in third and fourth positions. This figure should be compared with Figs. 59 and 61. If in either of these there is deficient flexion, as shown by the anterior fontanelle being lower than the posterior, the long rotation forwards as indicated by the arrows will not take place, but instead a short rotation forwards of the forehead, with the result that the occiput will slip back into the hollow of the sacrum as shown above. Note that the caput is formed nearly over the anterior fontanelle.

the biparietal diameter is in the wider oblique diameter. This is shown by comparing Fig. 51 with Fig. 60, and may be verified by placing the skull in the pelvis with the occiput first anterior and then posterior and noting the diameters occupied by the biparietal diameter in the two positions. The effect of this will be that if the head fits the pelvis tightly the biparietal diameter may be kept back while the forepart of the head descends. If for any of these reasons flexion of the head is deficient, the forehead may reach the pelvic floor before the occiput and so be rotated forwards under the pubic arch, the occiput slipping into the hollow of the sacrum. These cases are sometimes described as due to backward rotation of the occiput, instead of forward rotation of the forehead. They are termed "persistent" or "unreduced occipito-posterior" or "face to pubes" cases. The greatest difficulty occurs at the outlet, as the longer occipito-frontal diameter engages in the antero-posterior instead of the shorter suboccipito-bregmatic (Fig. 62). In these cases the mechanism may be described as deficient flexion, descent of forehead and internal rotation of forehead forwards through one-eighth of a circle, birth of the head by increased flexion and external rotation, the occiput again turning to the side to which it was originally directed. The way the head is born at the outlet is that

the forehead slips down behind the pubes, the root of the nose becomes fixed behind the symphysis and forms the point round which the head pivots, instead of the nape of the neck in anterior positions. First the vertex and then the occiput escape over the perineum and are pushed forwards by it, thus causing marked flexion of the head. As soon as the occiput is free of the perineum, extension occurs, and the forehead and face slip down from behind the pubes.

The Effect of Labour on the Child.

The shape of the child's head is altered by the pressure to which it is subjected during labour, both the soft parts and the bones being involved.

In the tissue of the scalp a soft puffy swelling forms on that part which is least exposed to pressure, and is known as the *caput succedaneum*.

The swelling is an œdema or dropsical effusion into the loose tissues of the scalp caused by the pressure on the head compressing against the skull bones the thin-walled veins, which return the blood, more than the thick-walled arteries, which bring the blood. This makes it more difficult for the blood to get away from, than to get to, that part of the scalp within the circle of pressure, and so the fluid constituents of the blood (plasma) accumulate in it and form a soft doughy swelling, which can be indented by the finger. In a precisely similar way, too tight a garter will compress the veins of the leg and cause an œdematous swelling of the foot and leg, which pits on pressure with the finger. Also, as will be seen when obstructed labour is studied, a swelling of the maternal parts may form when the head is so jammed in the pelvis that it compresses the pelvic veins between the head and the bony walls. This shows itself as an œdematous swelling of the anterior lip of the cervix and of the labia and other parts of the vulva.

The caput is formed for the most part in the second stage, but it may begin to form in the first if the membranes rupture early and the head is forced down strongly into a partially dilated os. The pressure of the tight ring of cervix will act like a garter and cause an œdematous swelling on that part of the head which is forced into the opening. The formation of the caput, however, generally takes place during the second stage, and becomes more marked the longer the head takes to pass through the pelvis. In a first position, the part of the skull below the posterior fontanelle is pressed against the left inner surface of the pubes, the forehead against the right posterior pelvic wall, and the sides of the head by left posterior and right anterior walls, so that the part least exposed to pressure is the top of the anterior or right parietal bone, which is towards the open space in front (Fig. 52). After internal rotation has taken place, so that the occiput is in front towards the open space under the pubic arch, the swelling develops nearly over the posterior fontanelle, and the more the head is flexed the more will it be over the occipital bone (Fig. 53). When the head is delayed for some time at the outlet, the caput may sometimes be seen to bulge through the vulva before the head is born. In the second position, the caput forms on the left parietal bone, as that one is anterior in this case (Fig. 56). In the third and fourth positions it forms much further forward—nearly over the anterior fontanelle—somewhat to the left of it in the third position and to the right of it in the fourth position (Figs. 59 and 61).

The term is not confined to vertex cases. The corresponding swelling which forms on the cheek in face cases and on the genital organs in breech cases is also for the sake of uniformity known as a caput succedaneum.

Two conclusions can be drawn from the caput. Its size gives some indication of the amount of pressure to which the head has been subjected, and so a large caput suggests a difficult labour. Its position gives some clue towards determining the position and presentation of child if examined immediately after birth, though it must be recognized that if the head has been long at the outlet, the original caput may be obscured by the last one formed. For instance, in an R.O.P. position the caput will form first on the anterior part of the left parietal bone close to the anterior fontanelle, but as the long internal rotation takes place the area of least pressure will be shifted backwards, so it finally comes to lie over the posterior part of the left parietal bone close to the posterior fontanelle. If, therefore, the head has been

delayed at the outlet, so that the largest part of the caput is near the posterior fontanelle, all that could be said is that the case was either an R.O.A. or an R.O.P. The swelling passes away in twenty-four or thirty-six hours after birth. As the circulation of the blood is essential to the formation of the caput succedaneum, it will not be present in dead or macerated fœtuses.

Moulding of the Head.—Considerable alteration can take place in the shape of the head owing to the bones of the vault being somewhat soft and not very firmly ossified and to a certain amount of "give" being allowed by the sutures. The vault of the head has, therefore, a certain amount of pliability and is "moulded" to some extent by the pressure to which it is subjected. As in the case of the caput, this varies with the presentation and the position, and is more marked the more tightly the head fits the pelvis. Naturally, too, it is best seen in the softer and less ossified heads than in the harder and well ossified ones.

If the diameter of the head which is most subjected to pressure is considered to be the one to be diminished in size, while the others increase, it will not be difficult to work out the changes which should take place in the various positions of the vertex. In the first position, the diameters compressed are the suboccipito-bregmatic and the biparietal; therefore the skull will be narrowed between the forehead in front of the anterior fontanelle (bregma) and the nape of the neck behind, whilst the head will bulge out over the back of the parietal bones near the posterior fontanelle. In other words, the suboccipito-bregmatic diameters will be diminished, while the maximum vertico-mental will be lengthened. Besides this there is more pressure behind, and therefore the parietal bone behind will be more depressed than the one looking to the open space in front: in the first position the left parietal bone will be depressed, sometimes so much so that the right overrides the left. Also, if there is much pressure the occipital bone, which forms part of the less compressible base of the skull and does not give in the same way as the bones of the vault, may slip under the parietal bones. Thus in a first vertex case, the head may be so moulded that its occipital end projects more than before, whilst the forehead is flattened down, and the right side of the head will bulge outwards whilst the left side is flattened. In occipito-posterior positions which rotate forwards a similar moulding—perhaps more marked—will take place, but in unreduced occipito-posterior cases, with the forehead behind the pubes and the occiput in the sacral hollow, the compression comes on the occipito-frontal diameter while the suboccipito-bregmatic escapes and therefore lengthens. Hence in these cases the head is narrowed between the occiput and forehead and bulged out behind the anterior fontanelle. so that the head has a "sugar loaf" appearance.

CHAPTER XI.

THE INVESTIGATION OF A LABOUR CASE.

The Diagnosis of the Onset of Labour.

It is sometimes impossible to say whether a woman is in labour or not until she has been under observation for some hours. The onset of pains is not sufficient, for they may be "false pains," and therefore in doubtful cases the following points must be carefully investigated:

The character of the pains must be noted to see if they correspond to true labour pains. These are felt by the patient to begin in the lower part of the back, and to work round to the abdomen, whilst the false pains are usually felt in the abdomen only. Further, if the uterus is examined when a true pain is present it will be felt hard and contracted and to relax as the pain passes off, showing that the pain is due to uterine contraction. This, however, is not in itself sufficient to determine that labour has begun, as sometimes the contractions of the later weeks of pregnancy become painful, and it is therefore necessary to continue the observation of the patient for some hours to see if the pains develop the full characteristics of actual labour. If this is done, the pains will be noticed to recur at shortening intervals and to last longer and become stronger, so that as time goes on the rhythmical character of the true labour pains becomes evident. The time between the pains and the length of time they last should therefore be noted. The interval may be an hour or more at first, and then half or quarter of an hour, whilst the duration of the pain may be at first a few seconds, and, later, a quarter or half a minute. The pain gradually works up to its height and then passes off. Also, the pains of labour produce dilatation of the os, and therefore vaginal examination at intervals would decide the matter, but is inadvisable as a single examination is rarely sufficient. The os may be dilated to the size of a florin before the onset of labour, so the important point is that a later examination should show that the pains are producing further dilatation. If the membranes are noticed to become tense and to bulge during a pain, that in itself indicates that labour has started. What is known as the "show" is also an important sign of dilatation, but is sometimes not seen till labour has been in progress a little time. It is a discharge of mucus from the cervix slightly stained with blood. The blood comes from the tearing through of the small capillary vessels which run from the uterine wall to the membranes, and is a sign that the stretching of the lower segment has caused the separation of the membranes round the os.

Sometimes important confirmatory evidence of the onset of labour in a multipara may be obtained by finding that the head has become fixed in the brim. This sign is of no importance in primipara, as in them the head is in the pelvis some weeks before the onset of labour.

The presence of a cervical canal is evidence that the patient is not in labour, or at most in a very early stage (p. 101).

False pains are often intestinal in origin and relieved by a thorough evacuation of the bowels.

The Diagnosis of the Presentation and Position.

The first duty of the trained midwife is to assure herself that there is nothing abnormal in the case, and it is incumbent on the pupil to acquire a systematic method of investigating every case which comes under her notice and to cultivate

the faculty of observation so as to recognize as early as possible that the labour is not normal. The system of note-taking suggested on page 337 is arranged chiefly to train the pupil in observation and to help her to acquire a systematic method of investigation, and will be followed in this chapter. The plan adopted in the Diagnosis of Pregnancy will also be followed, *i.e.* of going through the case as if the patient was before the student, and, though many of the observations, during the antenatal investigations (p. 78), have been made before labour, it will be best, for the sake of thoroughness, to describe the full examination as if the patient had not been seen before.

First of all, take the history of the patient, noting her age, and if she is a multipara, the number of previous labours and miscarriages. Obtain particulars of the last appearance of the menses and of the time of quickening, so as to decide whether labour is premature, or at term, or beyond term. Inquire as to the occurrence of troubles during the pregnancy which may afford evidence of possible complications during labour, such as irregular hæmorrhage suggesting placenta prævia, vaginal discharge, swelling of legs, hands, or face, sickness, headache, amount and character of urine, and other indications of the complications described in Chapters VII. and VIII. If the patient is a multipara, the history of her previous pregnancies and labours ought to be noted, especially if there were delay and difficulty in any of them—whether instruments were used and the babies were stillborn, and so on. If the mother is able to give information as to the size of her babies at birth, this is also useful. Besides these inquiries into the obstetrical history, the woman ought to be asked about her general health, whether she has been under treatment for any serious constitutional disease, kidney disease, heart disease, consumption, rheumatic fever, etc., and if she is short of breath.

After taking the history, the next thing is the examination of the patient, and this must be done systematically. First, make a few general observations as to the patient's appearance. Notice whether she is a small or a big woman, if she is very stout; whether she is well formed; look out specially for dwarfing, bow legs, or misshapen bones or other signs of rickets, all of which will suggest the possibility of pelvic contraction. Also notice if the face is puffy and anæmic, or if there is œdema or swelling of the hands, feet, or abdomen: if she is blue about the lips and cheeks, and short of breath, or has a bad cough. In hospital the pupil midwife will be taught to examine the urine for albumin, and this ought always to be done (p. 19). The pulse should be counted and a note made if there is any irregularity of the beat or if the pulse is small in volume or poor in strength. The temperature should be taken, even when there is no reason to think that fever is present, as a knowledge of the patient's temperature before labour may be of importance in deciding the meaning of a rise of temperature later on. If there is blueness of the face or shortness of breath the rate of respiration ought also to be noted (see Chap. VII., p. 80).

Abdominal Examination.

This is the most important part of the examination of the patient in labour, and with practice it will be found that earlier and fuller information can be obtained by it than by vaginal examination, whilst it has the further advantage that it can be repeatedly carried out without incurring any risk of infecting the patient. Hence every opportunity must be taken to acquire sufficient skill in abdominal palpation to enable the midwife to rely on it to discover the presentation and position of the fœtus. And this method of examination must be as carefully and thoroughly carried out in straightforward cases as in those in which there appears to be something abnormal, in order to obtain experience and to learn to appreciate at once any difference from the usual findings which would indicate some abnormality. The eyes must first be used to observe any peculiarity in the appearance of the abdomen (inspection), then the fingers must be used to detect the presentation and position of the fœtus by the sense of touch (palpation), and finally, the ears must be employed, either through a stethoscope or by direct application to the abdominal swelling, to listen for the fœtal heart sounds (auscultation).

Inspection.—It is as well, if the attendant has the opportunity, to note the appearance of the abdomen when the patient is standing up; in this position the protuberance of the abdomen is more marked and more striking than when the patient is lying down. A large and prominent abdomen may mean that the uterus is more distended than normal, owing to excess of liquor amnii, to the large size of the child or the presence of twins, or it may be that the abdomen is occupied by something besides the pregnant uterus, such as excess of fat, fluid, or a tumour. But perhaps the commonest cause of marked prominence of the uterus is weakness of the abdominal walls in women who have had many children, so that in extreme cases the fundus uteri hangs forwards in front of the pubes, producing the condition known as "pendulous belly" or extreme anteversion of the uterus. In such cases the child's head is not directed into the pelvic brim till labour had been in progress some time, perhaps not until after rupture of membranes, and the high position of the child contributes also to the increased abdominal distension. This condition is naturally much less marked when the patient lies on her back, so that the uterine tumour does not sag forward as it does when the patient is in the erect position. Again, patients in whom the accommodation for the pregnant uterus in the abdomen is limited by the small size of the abdomen, as in women of small stature and especially in women with spinal curvature in whom the ribs come down towards the pubes, the uterus projects forward much more prominently than in big women with a large abdominal capacity (Fig. 63). But the most important cause of marked projection of the uterine tumour is contraction of the pelvic brim, preventing the descent of the fœtal head into the pelvis, so that the child occupies more room in the abdomen than usual. This is a much more serious condition than the others, and it may be stated as a general rule that marked prominence of the uterus in women in their first pregnancy should always attract attention, and, as described on page 202, an examination should be made of the fœtal head to see if it is high above the brim and movable, and to test whether it can be pressed down into the brim or not. These cases may be distinguished from cases of pendulous belly in that the latter is found in multiparæ with thin and relaxed abdominal walls, and that it becomes less marked when the patient lies on her back, whereas the former will occur in primiparæ as well as multiparæ, and the prominence will remain as marked when the patient is on her back as when she is standing up, and the abdominal wall may be quite strong and muscular. Further, in the case of multiparæ a history

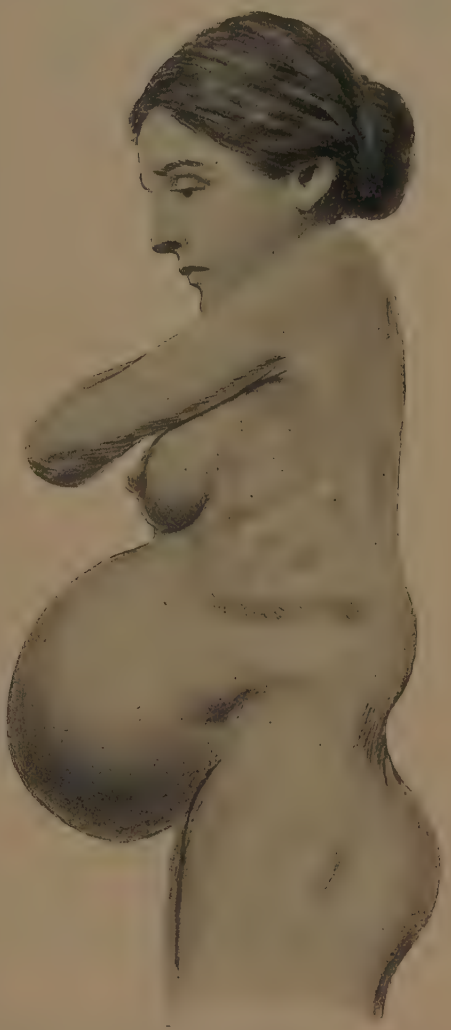

Fig. 63.—Pendulous Abdomen in a Primigravida, with Backward Curvature of the Lumbar Spine (Kyphosis). From a Photograph.

This patient had a normal pelvis. Labour was easy and terminated naturally. Note the small space between the ribs and the pelvis. This results in the pregnant uterus projecting forwards to obtain the necessary room for its increase in size.

of previous easy labours will negative pelvic contraction as the cause of the forward position of the fundus uteri.

In the examination, with the patient lying flat on her back in bed, several points ought to be attended to in order to get the best results. The patient ought to be lying comfortably, with the head and shoulders slightly raised and the abdomen fully exposed. She ought to be brought to the edge of the bed, so that she does not sink down into a hollow in the middle, and so placed that as good a light as possible falls on the abdomen. The general appearance of the abdomen is first to be noted; whether much enlarged, if so, the girth at the umbilicus should be measured with a tape; recent pink skin cracks will be noticed in cases of marked enlargement, especially at the sides; in multiparæ the old white striæ due to skin cracks of previous pregnancies will be seen. The abdominal wall may be very thin, so that the outlines of the uterine tumour are distinct, and perhaps projections of fœtal parts may be seen, and even fœtal movements may be visible. Bosses on the uterus may possibly be due to fibroid tumours. If the bladder is full it may form a prominence above the pubes, and, if so, will require to be emptied before palpation is begun. The skin above the pubes may be swollen and red and show folds formed by the overhanging belly wall, especially seen in fat women with a thick abdominal wall. In transverse lies the uterus is broader than usual and does not rise so high.

Palpation.—This is the most important part of the examination. The patient's knees should be slightly drawn up to relax the abdominal muscles, the attendant's hands should be warm, and it is often advisable to engage the patient in conversation so as to keep her attention occupied. The hands should be laid nearly flat on the abdomen, the tips of the fingers being pressed inwards, as they are the sensitive parts. If the manipulation starts a uterine contraction, examination must be delayed till this has passed off.

To conduct this part of the examination properly, the pupil must learn a systematic way of doing it, and the order in which it is done varies with different teachers. The actual order does not matter much so long as a definite plan is adhered to; the pupil is often taught to begin at the fundus and work down to the pubes. This has always appeared to the writer to be beginning at the wrong end. The first and most important thing to be found out is what is presenting, and that is found out by examining at the pelvic brim. Further, the examination at the brim is easier and less liable to lead to error than the fundal examination, and hence the plan of beginning below will be described here. But before endeavouring to map out the position of the fœtus in the uterus, it is as well to run the fingers over the whole abdomen and define the height of the fundus and note the tenseness of the uterus, and to obtain some impression of the thickness or rigidity of the abdominal wall. This preliminary examination also accustoms the patient to the manipulation and restores her confidence if she is nervous.

In trying to map out the fœtus the examination is best done in the following order: (1) The pubic examination; (2) the umbilical or mid-abdominal; (3) the fundal.

1. *The pubic examination*, as the great majority of presentations are by the vertex, really consists in the effort to find the head at the pelvic inlet, and should be conducted in the following way. Stand facing the patient's feet with the hands on each side of the middle line; with the finger-tips feel the pubic spines on each side of the symphysis. This defines the anterior border of the pelvic brim. Now draw the fingers a little higher up the abdomen and a little out to the sides, and then sink them down into the pelvic cavity and press them in towards the middle line. In primigravidæ the head normally has sunk into the pelvic cavity long before labour begins, and in multiparæ soon after labour has begun, and hence, in the great majority of cases, the hard round head will be felt between the fingers of the two hands if they are pressed into the pelvic cavity from the sides as described. If the head has not sunk into the pelvis, it may be felt higher up and may be found to be so movable that it can be pushed from the fingers of one hand to those of the other. If it is deep in the pelvis, it will be recognized as a hard round mass below the fingers. Sometimes it is noticed that one side of the head is higher and more prominent than the other—the forehead when flexion is well marked, and the occiput when

extension is present. Hence if the more prominent part of the head is on the opposite side to the child's back, the head is flexed ; if the more prominent part is on the same side as the back, the head is extended. This is generally shown by the fingers sinking down more easily on the less prominent end of the head, *e.g.* on the occipital end (the same side as the back) when flexion is good. The points to be made out

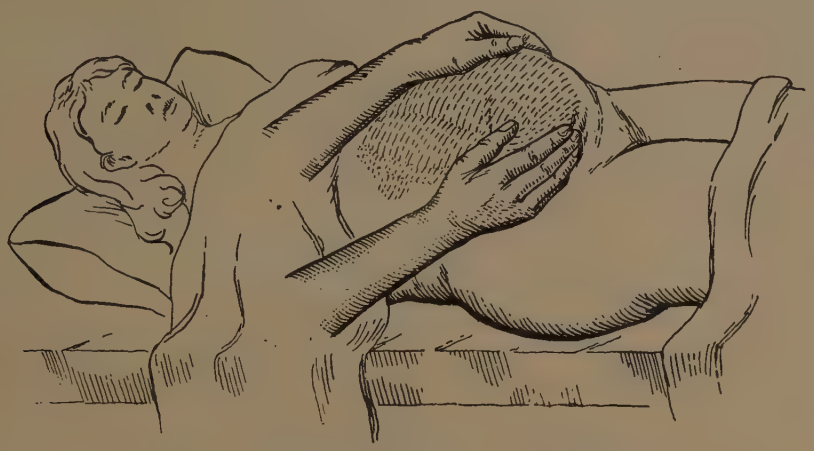

FIG. 64.—ABDOMINAL PALPATION. PUBIC EXAMINATION.

The hands are placed one on each side of the pelvic inlet and the finger-tips are sunk in towards the pelvic cavity so as to find the head. If the hard round head is recognized, an endeavour is made to discover whether it is high or low in the pelvis, movable or fixed in the brim, and if one end is more prominent than the other. If the head cannot be felt, the presentation is either a breech or a shoulder.

in the suprapubic abdominal examination are—(1) Try and define the head ; if the head is definitely recognized in this position, the presentation is evidently either vertex, brow, or face ; if the head cannot be felt, it is probably either a breech or shoulder presentation. (2) If the head is presenting, note whether the head is high or low in the pelvis, and if it is fixed or movable ; if the head is high and freely

FIG. 65.—ABDOMINAL PALPATION. MID-ABDOMINAL EXAMINATION.

The finger-tips run across the pregnant uterus from one side to the other feeling for the resistant back. When the firm back is located it is followed downwards to the pelvis and upwards to the fundus. On the other side to the back will be found the small fœtal parts and the softer elastic feel of the liquor amnii contained in the bag of membranes.

movable, it is not engaged, and the reasons for its non-engagement must be investigated (p. 202). (3) Note if one part of the head is more prominent than another and if the prominence is on the same or on the opposite side to the back ; marked projection of the head on the same side as the back indicates extension of the head.

2. *The umbilical or mid-abdominal examination* serves to locate the back and

small parts of child. Stand looking directly across the patient, and run the finger-tips across the uterus from one side to the other, dipping them gently inwards and trying to estimate the feeling of resistance or hardness to be met with as they cross from one side to the other from below the umbilicus upwards. If the back of the child is directed forwards, a firm resisting mass will be felt on one or other side, while on the opposite side there will be a softer and more elastic feel with the knobbly small parts of the fœtus. If the pubic part of the examination determines the presentation, this part is important in determining the position and must be practised with great care; if the resistance of the back is discovered, it must be followed upwards towards the fundus where, in head presentations, it will be found to end in a rounded upper end—the breech, and the less resistant part must be palpated for the knobs of the fœtal limbs. If the small parts are felt all over the front of the abdomen, the back probably lies towards the side and back of the mother, and careful palpation far round in the flank must be made to ascertain to which side it is directed. If there is difficulty in locating the back, place the flat of one hand on one side of the uterus and push the uterus over to the opposite side so as to make the back project

FIG. 66.—ABDOMINAL PALPATION. FUNDAL EXAMINATION.

The hands are on each side of the fundus. In this case the right hand is being passed over the breech to note how it forms the upper rounded extremity of the back. The left hand is feeling the small parts (the feet) on the other side. Should the head have been missed from the pelvic brim, these conditions will not be found in the fundus and the head should be looked for, the fingers being used as shown in Fig. 64, dipping in firmly to try for the ballottement of the head. If the fundus appears empty, careful examination should be made for a transverse lie.

as much as possible, and then try with the fingers of the other hand to discover which side seems the firmer or seems to contain more of the knobbly joints. By doing this alternately, first on one side and then on the other, or with both hands flat on each side of the uterus, the side on which the back will be found. The anterior shoulder can often be recognized as a projection from the back to one or other side of the middle line, midway between the umbilicus and the groin.

3. *The fundal examination* is the most difficult part, and is chiefly to confirm what has been made out in the pubic and umbilical examinations. In the usual vertex presentation the breech will be recognized as the rounded upper extremity of the firm back—on the same side as the back; on the other side of the fundus are felt the small knobs of the knees and feet, and here generally the fœtal movements are most marked. For this part of the examination the midwife should stand so as to face the patient and lay the hands one on each side over the fundus; with the fingers try and feel the rounded breech, continuous with the back, and on the opposite side to the back, the knobbly small parts. The breech feels harder than the rest of the back owing to the sacrum being more easily felt than the softer buttocks, and this hardness often leads to confusion with the head. If the head has not been felt

below, and the case is therefore thought to be a breech presentation, the head must be sought for in the fundus. The head is harder, larger, rounder, and more movable than the breech, and does not appear so directly continuous with the back, and a prominence corresponding to the anterior shoulder may be noticed projecting from the back above the umbilicus. The most characteristic feature of the head in the fundus is that it ballots when firmly tapped by the fingers, because it can be moved independently of the trunk ; when the mass in the fundus is thought to be the head, the finger-tips should be sharply dipped in on to it, when the sensation of a hard round body moving a little on the back will be obtained (p. 73). The head can also be tossed from the fingers on the one side to that on the other. The part of the fœtus felt in the fundus should be contrasted with the part presenting at the brim, the points of difference noted and the features mentioned above looked for in both places. Only by a careful comparison of the two ends of the fœtus is correct differentiation between head and breech likely to be made.

There are other points besides the presentation and position of the fœtus which can be determined by abdominal examination. Twins may be discovered by the presence of two heads or two backs. Contracted pelvis may be suspected from the non-engagement of the head in the brim in a primigravida or after labour has begun

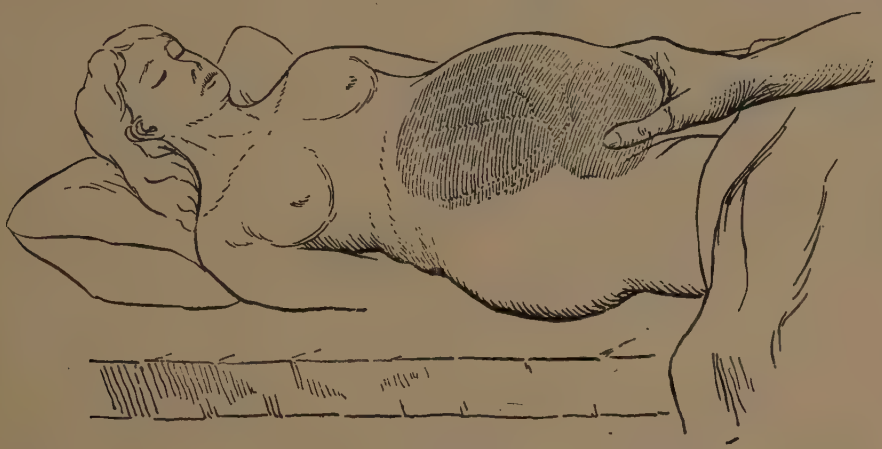

FIG. 67.—ABDOMINAL PALPATION. ONE-HANDED GRIP OF THE HEAD AT THE BRIM.

The head is grasped between the fingers and thumb to discover if it is movable above the brim. This also helps to distinguish the head from the breech. If the presenting part can be readily grasped and moved about it is not likely to be the breech By turning round, reversing the grip and pressing the head down into the brim, it is possible to obtain some impression as to whether the head will fit into the brim.

in a multipara. If the head is not fixed in the brim, it may be due to the head being too large for the pelvis, *i.e.* either a large head or a contracted pelvis, or it may be due to pendulous belly and marked obliquity of the uterus interfering with the direction of the head into the pelvis, or to tumours, placenta prævia, twins, or malpresentation preventing the head entering the brim. For trying to determine whether the head is movable above or will or will not enter the brim, a special method of examination is employed. The midwife with one hand grasps the head so that the thumb is on one side and the fingers on the other, and moves it first from side to side, showing that it is free and not engaged ; next she presses it down firmly into the pelvis, and if it is too large or the pelvis too small, or if there is something preventing it going down, it will be stopped by the hard rim of the pelvis and may bulge over the symphysis and form a prominence. This single grip is also useful in helping to distinguish the harder, rounder, and more movable head from the softer and less movable breech.

For some reason the term "grip," which is justifiable in this last-described method of examination, is frequently extended by candidates at the C.M.B. examination to the pubic, mid-abdominal, and fundal palpation, to all of which it is quite inapplicable. The very thing the pupil has to learn when palpating the abdomen

is not to "grip,"—if she grips, she cannot feel. When one tries to feel anything a soft touch is used to bring out the sensitiveness of the finger-tips. A "grip" suggests strength, not delicacy of touch, of which, indeed, it is destructive. The term "grip" ought not to be applied indiscriminately to abdominal palpation, because it gives a wrong impression of the way palpation should be carried out, but should be reserved for the last-described manœuvre in which a sensitive touch is not required, but the part grasped firmly in the hand, and waggled to and fro to test if it is movable above, or fixed in, or can be forcibly pressed into, the brim, or to see if it is movable on the trunk or immovable apart from it.

Auscultation.—The fœtal heart must now be listened for, and this may be done through a stethoscope or by putting the ear directly on to the abdomen with only a thin sheet or towel over it. The fœtal heart is heard best over the back, and therefore ought to be listened for first on that side on which the back has been located. In vertex positions it is heard best below the umbilicus, about midway between it and the groin on the left or right according to the position. The fœtal heart sounds are generally compared to the ticking of a watch under a pillow, and once distinctly heard can easily be distinguished by the pupil. In order that they may not be confused with the maternal heart sounds, a finger should be placed on the pulse so as to notice that they are of a different rate and rhythm. An effort should be made to count the fœtal heart, and the place on the abdomen where they are best heard should be noted. The rate is generally about 120 to 140 per minute; slowing and irregularity is a sign of fœtal distress. Hearing and counting the fœtal heart, then, shows that the child is alive, and gives an indication of the condition of the fœtus. The position where the sounds are best heard helps in the diagnosis of position in the following way. In vertex presentations the maximum intensity is midway between the umbilicus and the middle of the groin—on the left side in the first position; on the right side, but nearer the middle line, in the second position. In the third and fourth positions, *i.e.* when the back is towards the sacro-iliac joint, the heart is best heard further out towards the flank, and is generally fainter and more difficult to find than in occipito-anterior positions.

In face presentation the heart sounds are best heard over the chest, *i.e.* on the same side as the limbs, and not over the back, and hence are not so easily heard in the third and fourth positions.

In breech presentations the heart is heard higher up in the abdomen and over a wider area than in vertex presentations, generally at the level of, or above, the umbilicus. In a first position of the breech it is usually best heard a little to the left and above the umbilicus, and in a second position in a like situation on the right side. In the third and fourth positions the heart sounds are not so readily heard, but may be found anywhere above the umbilicus, as the sounds may be conducted through the head or other parts of the fœtus.

In twin pregnancies there may be two places where the heart sounds are of maximum intensity, and if the rate can be counted and is different, it is the most positive sign of the presence of twins.

Vaginal Examination.—This consists of (1) inspection, and (2) internal palpation or examination of the pelvis by the finger. The first part, the inspection of the vulva and vagina, is generally best carried out at the time the midwife is cleansing the external genitals, preparatory to making the internal examination. On inspection she should note any œdema, swelling, ulceration, or large varicose veins about the outlet; the state of the perineum; any hæmorrhage or purulent or other discharge from the vagina; prolapse of vaginal walls or uterus. Several of these conditions are mentioned in the C.M.B. Rules as calling for medical advice (E 21 (2) and (3)).

The second part, or internal examination proper, is made after due precautions have been taken, and in the manner described elsewhere (p. 135–6), and attention is directed to (1) the maternal soft parts, (2) the present part, and (3) the maternal hard parts, *i.e.* the bony pelvis.

1. *The condition of the vaginal walls is noted*, whether moist or dry, and whether the rectum is loaded, as shown by the posterior wall being bulged forward by fæcal matter. The cervix is then examined; it may be found that the canal is not yet

taken up, so that the finger can be passed up for an inch to the internal os, showing that labour either has not commenced or is in a very early stage. Or there may be no projection of the cervix, but merely an os (the external os) through which the membranes and presenting part can be felt. The amount of dilatation must be carefully noted, and the state of the lips of the os. Early in labour the os may just admit one finger, *i.e.* may be about the size of a shilling; later, it will admit two or three fingers (equal to the size of half a crown or crown piece), and towards the end of the first stage, only a rim of os may be felt round the presenting part. Usually the anterior lip of the os is the last part to be drawn up, and sometimes when it is nipped between the head and the symphysis pubis, it may form an œdematous swelling in front of the head. The consistence of the os, whether hard and rigid or soft, should be noted, also if there is any ulceration or tumour of the maternal soft parts.

2. *The presenting part is now to be investigated*, and, first of all, the condition of the bag of membranes. If unruptured, the membranes may be felt through the os, if it only just admits a finger, or bulging down through it, if the os is more dilated, and becoming tense during a pain. The bag generally projects in a flattened rounded shape usually described as like a watch glass, but in rare cases comes down like the finger of a glove, and then is likely to rupture early, and so the chance of feeling it in this shape is a very poor one. A long projection of the membranes suggests contracted pelvis or some malpresentation, as it is caused by the presenting part not sinking down into, and filling up, the lower part of the uterus and so cutting off the full force of the general intrauterine pressure from the fore-waters. If the membranes are ruptured the finger will not readily discover them, but will feel the presenting part. Placenta or cord or a fœtal limb may be felt in certain abnormal cases.

If the presenting part can be reached by the finger, its nature and position must be decided. The vertex forms a hard round mass on which can be felt the scalp, swollen by the formation of the caput succedaneum (p. 121), if the membranes have been ruptured for any length of time. When possible, the finger should be carried up behind the symphysis and backwards to the sacral hollow and over the sides of the head, in order to find the landmarks by which the position is verified. The first thing is the sagittal suture, which should be followed forwards and backwards till the fontanelles are reached. The posterior fontanelle is generally easily reached, because the flexion of the head brings the occiput low down, and, in the first and second positions, it lies to the front (Figs. 52, 53, and 56). It is distinguished by having three sutures running into it and no soft floor. If the labour has been long enough in progress for some moulding to have taken place, the occipital bone will be depressed under the parietal bones, so that the finger, if passed beyond the end of the sagittal suture and drawn back again, will feel the raised edge of parietal bone, which thus indicates the position of the occiput. The anterior fontanelle is recognized by having four sutures running into it, by its having a soft floor, and by its diamond shape. By following it the sagittal suture will be found to lie in one or other oblique diameter of the pelvis—if in the right oblique diameter with the posterior fontanelle to the front, it is a first vertex (Fig. 52); if with the anterior fontanelle forwards, a third vertex (Fig. 59); if the suture is in the left oblique diameter with the posterior fontanelle forwards, it is a second vertex (Fig. 53); if with the anterior fontanelle forwards, it is a fourth vertex (Fig. 61). If the back has been definitely located by abdominal palpation, the posterior fontanelle must be on the same side of the sagittal suture. In difficult cases, if the finger can be passed up the side of the head so as to feel an ear, this will assist in the diagnosis of the position, as the free border of the ear points backwards to the occiput. An attempt should be made to determine whether the head is well flexed or not. If the posterior fontanelle is low down and easily reached, and the anterior is high up and out of reach, flexion is well marked. A low position of the anterior fontanelle, indicating deficient flexion, is generally found in unreduced occipito-posterior positions, and hence the finger coming easily on this fontanelle, ought always to make the midwife think of this condition (Fig. 62). It is good exercise to learn to recognize sutures and fontanelles by feeling the head of the newborn child with the eyes shut.

The next point to be noted is whether the presenting part is high or low. It may be so high up that it is out of reach, and its nature unascertainable, in which case the rules of the C.M.B. lay down that a doctor must be called in. It may be felt bulging down through the brim and easily pushed out of the pelvis, or it may be fixed there. It may have passed through the brim so as to occupy the pelvic cavity, or it may be right down at the outlet.

If the presenting part is not the vertex, then its nature and position must be determined as described under face, breech, etc. When the midwife cannot make out the presentation, the help of a doctor must be obtained (Rule E 21 (3)).

3. *Maternal bony pelvis.* Unless the presenting part is too low down, an attempt should be made to reach the sacral promontory, two fingers, the index and middle finger, being necessary for this, and if the promontory can be touched by the middle finger, the diagonal conjugate should be measured as described on page 203, and the true conjugate deduced from this by subtracting half an inch. A narrow pubic arch, small width between the ischial tuberosities, and marked projection or immobility of the coccyx should also be looked for.

Conclusions from Results of Examination and Observation during the Labour.—In order to acquire skill in diagnosis it is a good plan for the pupil to note carefully at every case what conclusions she draws from her examination, and check them by watching the mechanism, observing the position of the caput succedaneum and the moulding of the fœtal head. She will thus learn whether her opinion has been correct or not, what evidence has been of most value to her or where she has been led astray, and so will learn both from her successes and failures in diagnosis. She should even go further than this by trying to form an estimate on many points on which exactitude is impossible—the amount of liquor amnii, the size of the child, the possible duration of the labour, if assistance is likely to be required, and so on. By taking into account the history of previous labours, the character and build of her patient, the points noted on examination, and her observations during the progress of the labour, she may train herself to acquire some of that wonderful insight into these speculative matters that may be found in midwives of long and wide experience. Owing to their being continuously with their patients throughout the labour, these women learn the art of forming a remarkably accurate judgment on many points, on which the doctor, who is only present at intervals, comes to rely. It is acquired by close observation among cases of many and varied types which only time and opportunity will bring. Careful and systematic observation can be cultivated, and by forming an opinion on what she finds and noting how far it has been justified will assist in learning judgment.

CHAPTER XII.

SURGICAL CLEANLINESS AND ITS APPLICATION TO MIDWIFERY PRACTICE.[1]

Surgical cleanliness means more than ordinary cleanliness; it means cleanliness carried to such a degree that no bacteria are present. For example, a pair of scissors or forceps may be as clean as they can be made by washing and polishing, and yet may not be surgically clean. Some minute organisms may be clinging to rough places on their surfaces or about the joints, so that no amount of scrubbing will get rid of them, and this is especially likely to be the case if they have been used in operations where there is pus. If these instruments are boiled for five or ten minutes, *i.e.* long enough to kill all organisms which may be adhering to them, or if they are placed in strong chemical disinfectants for a time sufficient to effect the same purpose, then they may be said to be surgically clean. When this is the case they cannot be the means of conveying germs to anything with which they are brought in contact. Before going any further it is necessary to explain two terms which are constantly being used in reference to the means adopted to secure surgical cleanliness.

Aseptic and Antiseptic.—Aseptic simply means germ free; scissors or forceps boiled for ten minutes are germ free and therefore are aseptic. Boiled water is aseptic, and so are wool, gauze, or sponges after having been heated in a steam-sterilizer long enough to kill all organisms. Suppose instead of boiling the water, carbolic acid or perchloride of mercury or other chemical disinfectant is added to it, then an antiseptic solution is obtained, because the water now contains something which will kill micro-organisms. Boiled water is germ free, but contains nothing which will kill micro-organisms; a 1 in 1000 solution of perchloride of mercury will destroy them. Similarly, sterilized wool is germ free, while "sublimate" wool or gauze is germicidal or antiseptic. Both aseptic and antiseptic methods are used in surgical and obstetric work, so that it is necessary for the midwife to understand what is meant by the terms in question.

Roughly speaking, asepsis, or the aseptic method, is working with germ-free or sterilized materials; antisepsis, or the antiseptic method, is working with chemical solutions strong enough to kill bacteria. In midwifery work it is usual to use both methods, the aseptic for instruments, dressings, and anything that can be boiled, and the antiseptic for the final cleansing of the hands and external genitals.

As the safety of modern surgical operations depends on a strict adherence to these methods, so too does the safety of the woman in child-bed, and every one who aspires to help women during labour or lying-in must understand and carry out implicitly every detail of the technique of surgical cleanliness. If the midwife does not do so, she will be a source of positive danger to her patients, rather than a help. The pupil need only turn to the chapter on Puerperal Infections (p. 237) to realize what may happen as the result of carelessness or neglect in carrying out these methods.

The best way to explain the details of surgical cleanliness will be to consider what the surgeon does when he makes a clean operation wound—say in the case of a Cæsarean section or the removal of a fibroid or ovarian tumour.

Organisms may obtain access to the wound from—(1) the air, through dusty particles; (2) the skin of the patient round the wound; (3) the hands of the surgeon or his assistants, or by coughing or sneezing and distributing infective particles from

[1] Before beginning this chapter the section in the Introduction on "Bacterial Infection" (p. 23) should be read.

throat or nose ; (4) the instruments and materials, such as ligatures and sponges used in the operation.

(1) *Infection through the air* is now known to be of little importance ; care is taken to avoid stirring up the dust in the room before an operation, and the wound is sponged out at intervals with boiled water or an antiseptic solution. The organisms in the air are mainly saprophytic and will not survive in the living tissues. Naturally, as well-ventilated and as hygienic a room as can be obtained is chosen to lessen the risk of infection. Spray infection from the throat, mouth, or nose of attendants may be conveyed through the air, either direct to the wounds or indirectly by falling first on instruments or dressings. For this reason, the operator and others in the theatre usually wear masks of muslin to filter droplets from the expired air. Coughing, sneezing, laughing, or even talking are specially liable to convey spray infections.

(2) *The skin round the operation area is carefully prepared.* Where there are hairs the part is shaved and thoroughly cleansed with ether soap. Sometimes an antiseptic compress is put on some hours before the operation, but the most usual method is to paint the skin two or three times with a solution of iodine in rectified spirit (2 per cent.) or picric acid in spirit, the last application being made just before the operation is begun. When the skin has been disinfected, the operation area is surrounded with sterilized towels, just leaving room for the surgeon to work.

(3) *The cleansing of the hands* of all who assist, being so essential a part of the operation, must be described in detail.

The hands are first scrubbed with a nail-brush in hot soap and water for seven minutes, great care being taken to clean those parts, such as round the nails and the rough parts of the fingers, where dirt is likely to collect. In hospitals, where a plentiful supply of water is at hand, this scrubbing is done under running water, or the water is frequently changed. In a private house, where the supply of water and basins may be limited, a thorough scrubbing in one basin for five minutes, and another in a basin of clean water for two minutes to get rid of the soap-suds and dirty water, may be substituted. After the soap has been well washed out of the hands, they must be soaked and rubbed in some antiseptic lotion for three minutes, and may then be considered surgically clean provided they touch nothing unclean and thus become contaminated again. Hence before operating the hands must not be allowed to come in contact with anything not sterilized. If they rest on a chair or a table, or are used to lift a pail or jug, the whole process of cleansing must be gone through again, for they are no longer surgically clean. It may be well at this point to draw attention to the necessity of a thorough scrubbing of the hands. It is by far the most essential part of the process. If it is not most thoroughly done, no amount of dabbling in antiseptic lotions will make up for it. It is necessary not only to remove the dirt which has been rubbed into the hands, but also to get rid of the dead epithelium on the surface and the natural grease, which is always present in the skin. If this is not done the antiseptics cannot get at the organisms, which are protected from their action by a greasy covering. As the hands are the most likely source of infection, the further precaution is taken after cleansing as described to put on rubber gloves which have been sterilized by boiling or by steam.

(4) *The care of instruments and ligatures and sponges* is also of paramount importance, for not only do they come into the wound itself but the sponges are rubbed into it and the ligatures are left in the body, so that any organisms which they contain are left with them. The surgeon therefore prefers instruments which will boil, as that is the safest and best method of ensuring that they are germ free. All metal and glass instruments are boiled for ten minutes before use. When this cannot be done they are placed in a strong antiseptic solution, *e.g.* carbolic acid 1 in 10, for half an hour. During the operation all instruments lie on a sterilized towel or in a tray of sterilized water or weak antiseptic (carbolic acid 1 in 60). All sutures and ligatures are boiled when possible or treated with strong antiseptic, and so with sponges and dressings.

To minimize the danger of infection by contact the surgeon and all assistants are clothed in sterilized overalls, and the C.M.B. expects a like precaution from the midwife. " When attending to patients she must wear a clean dress of washable

material that can be boiled, such as linen, cotton, etc., and over it a clean washable apron or overall. The sleeves of the dress must be made so that the midwife can tuck them well above the elbows " (Rule E 2).

If throughout the operation neither the surgeon nor the assistants allow anything unclean to come into the wound or to come in contact with anything which goes into the wound, the whole proceeding, even if it lasts more than an hour, may be carried out, and the wound closed and dressed, without the slightest infection taking place. As a consequence the wound will heal by first intention, *i.e.* without suppuration taking place and without inflammation. In such cases the patient recovers without fever and escapes the danger of blood-poisoning.

It is the application of these methods which has made possible the big operations of modern surgery. The risks of abscess formation and septicæmia or blood-poisoning, which in the old days were a terrible danger even in the most trifling operations, are now so minimized that extensive surgical procedures never dreamed of then are now carried out with most excellent results. What is true of surgery is also true of midwifery, and the careful and conscientious applications of these same principles in the care of the lying-in patient has led to an improvement in child-bed recoveries but not equivalent to that in surgery.

The attendant on labour like the surgeon at an operation must observe the same scrupulous care to avoid bacterial infection. Though the principles are the same in both, a ritual of its own must be worked out for the lying-in room, *i.e.* modified to meet special conditions and circumstances in which labour takes place. All that can be done here is to sketch the general principles underlying the application of the methods of surgical cleanliness to midwifery, and in doing so a combined antiseptic and aseptic technique will be followed. The student must learn the details and the practice of these methods in the labour room and by the bedside, and unless her training has been strict and unless she has learnt the methods so well that they have become part of her, so that she carries them out automatically and without thinking, she will never become a good or trustworthy attendant at labour.

" The midwife must be scrupulously clean in every way, including her person, clothing, appliances, and house ; she must keep her nails cut short and preserve the skin of her hands as far as possible from cracks and abrasions " (C.M.B., E 2). In cold weather especially she ought to think of the possibility of chaps and cracking of the skin, and always wear gloves out of doors, and use some emollient glycerine preparation to keep the skin soft.

Naturally, she must make the best of the houses in which her work lies ; the more unhygienic, the dustier, and the dirtier the houses, the greater will be the risk of infection, and therefore the most minute details of the technique must be observed to avoid the introduction of organisms.

Hints on the arrangement of the room and of the management of the patient before labour will be found elsewhere (p. 142), here will be considered only the preparation of the patient at the time of labour and of the midwife's hands and instruments.

Just as the surgeon cleanses the skin round the area of operation, so the midwife must cleanse the vulva and its neighbourhood. It is not practicable to shave the parts as the surgeon would do, but the hair on the labia ought to be clipped short with scissors ; this will make the cleansing more effectual at the time and will render easier subsequent cleansing throughout the lying-in time. The external genitals and the surrounding area of the buttocks and thighs must be thoroughly washed with soap and warm water, particular attention being paid to the folds between the labia, the neighbourhood of the clitoris, and round the anus. All greasy matter, dried discharge, and such-like must be got rid of. Next rinse the parts with clean water to remove all soap, and swab them with an antiseptic solution—1 in 1000 perchloride or biniodide of mercury is one of the most efficient and most widely adopted—and then leave a sterilized towel or gauze covering, wet with antiseptic solution, over them to prevent soiling. In ordinary district practice, the best time to do this cleansing of the patient is after the abdominal examination has been finished. The patient is then brought to the edge of the bed, in position for the vaginal examination, washed up in this way—and while doing this the midwife makes a careful inspection

of the parts, looking for ulcers or varicose veins and the state of the perineum externally, for vaginal discharge or other abnormality internally. The C.M.B. regulations say : " The midwife must wash the patient's external parts with soap and water, and then swab them with an efficient antiseptic solution on the following occasions :

(*a*) Before making the first internal examination ;
(*b*) After the termination of labour ;
(*c*) During the lying-in time ;
(*d*) Before passing a catheter.

The swabbing with antiseptic solution must be repeated before each further examination and before a douche is given. For this purpose the midwife must on no account use ordinary sponges or flannels, but material which has been boiled or otherwise disinfected before use " (E 8).

After the cleansing of the patient is completed, she is left in position for the internal examination with the towel or pad over the vulva whilst the next procedure, the cleansing of the hands, is proceeded with. " Before touching the generative organs or their neighbourhood the midwife must on each occasion disinfect her hands and forearms " (C.M.B. Rules, E 4). If a sheet or blanket is left over the patient's buttocks, it should be left so that it can be lifted out of the way by the elbow before the examination is made.

The sleeves are rolled up above the elbows and the forearms left bare. With a nail-brush and soap and hot water, the hands are thoroughly scrubbed all over. The time to be spent at this cannot be stated exactly, it must be long enough to get the hands as clean as they can be made ; this usually takes from five to seven minutes. The parts round the nails, the pulps of the fingers and the spaces between the fingers are to be carefully gone over ; also the sides of the hands. During a vaginal examination the space between the first finger and thumb is rubbed against the anterior vaginal wall and that between the second and third fingers against the posterior vaginal wall and perineum, and so, if neglected, may prove a source of infection. To complete the washing, the hands must have a final scrub in fresh water, so as to get rid of the soap and dirty water. Next the hands must be treated with one of the antiseptic solutions mentioned elsewhere. They must not simply be dipped in this, but must be soaked in it for two or three minutes, and the hands and forearms rubbed with the lotion, with or without the use of a nail-brush. Before rubber gloves came into general use it was advised that the hands should *not* be dried after soaking in lotion, as the wet hands are less likely to be used to touch anything than if they were dry. Chemical solutions make it difficult to draw on the gloves, so it is better to rinse them in cooled boiled water and then lubricate them with ether soap (or other liquid soap) dropped on to the hands by an assistant.

Rubber gloves should always be used, as once the midwife is accustomed to them, the loss of tactile sense is negligible. The important points to remember in regard to them are : (1) that the washing of the hands must be done as carefully as if they were not used, for fear of injury or leakage occurring ; (2) gloves readily become soiled, and therefore should be sterilized by boiling after each examination or if they come in contact with anything that is not sterile ; (3) precisely the same precautions must be taken to avoid soiling by the external genitals when passing the examining fingers.

The patient having been placed on her left side, the vulva cleansed as described, and a pad left on while the midwife completes her preparation, she, with gloved hands, comes to the bedside to make the examination. The left elbow may be used to lift out of the way any clothes, and the hand to raise the right labium so as to expose the entrance into the vagina ; the pad is then removed and the first two fingers passed straight into the vagina without touching anything, not even the patient's skin. A lubricant is not necessary ; at the end of pregnancy or the beginning of labour, the natural slimy secretion of the passages is sufficient, and no artificial product is required. There are objections to all such. None of them are free from reproach (except perhaps " glycerine and perchloride "), as the oil or grease prevents the action of the antiseptic. The pomatum pot of carbolized vaseline is useless as far as antiseptic properties are concerned, and by the frequent sticking of fingers

into it, becomes a source of contamination. The squeeze tubes are better, but they require an extra hand and therefore only tend to make strict surgical cleanliness more difficult. Lubricants had only one advantage, and that is that they protected the examining finger by the layer of grease covering it. They are not required for the gloved finger and gloves are absolutely essential when attending any woman who has sores about the generative organs (C.M.B. Rules, p. 68 ; C.M.B. for Scot., p. 66). One other point is that the attendant must expose the patient, and not attempt to examine under the bedclothes ; if all this care is taken to avoid contamination it is useless to nullify it by fumbling about under the bedclothes.

The instruments used by the midwife are few in number, and therefore there is no excuse for want of care in sterilizing them. They should be of a material which will allow of their being boiled. Douche nozzles, catheters, scissors, and so on should be boiled in a small sterilizer or saucepan before use, for at least ten minutes. They should then be put into antiseptic lotion till required, and used direct from this. By adopting the same plan as recommended for vaginal examination, and exposing the parts so that the instrument is passed straight out of the lotion into the canal without touching anything about the patient or the patient herself, the passage of the douche nozzle or catheter may be effected without chance of contamination. All instruments, too, should be very carefully cleaned after use, so that no blood or discharge is left to dry on them, and so add to the difficulty of cleaning them. A small pinch of soda (washing or baking soda) is of advantage in preventing the rusting of steel instruments and in removing fat and grease. Great care must be taken to prevent rusting or corrosion of scissors or forceps, as any rough surface holds dirt.

The dressings used are clean pads or towels, which are frequently changed ; better are those of wood-wool or absorbent wool, and best of all, those of sterilized or medicated wool. Should any material be required for insertion into the vagina, as in the operation of plugging, it must be thoroughly sterilized by boiling or soaking in a non-poisonous antiseptic before use, and the usual precautions taken to avoid its being soiled. As much care and attention must be devoted during the lying-in period in preparing for any procedures about the genital organs as is the case during labour, and so also in keeping the parts scrupulously clean. This will be fully described in the chapter on the Management of the Puerperium. The C.M.B. lays down the rule (E 5) that " All instruments and other appliances must be disinfected, preferably by boiling, before being brought into contact with the patient's generative organs."

To sum up, then, the duty of the attendant on an obstetric case is to use every means to prevent any chance of infection of the patient. This can only be done by making the surroundings as little likely to be a cause of infection as the circumstances permit, and by taking care that, whatever the surroundings, nothing enters the vagina which is not, in the strictest sense of the words, surgically clean and that everything about the vulva is kept so clean that no infection will spread upwards from there.

The precautions insisted on in this chapter may seem to many to be too complicated for ordinary practice, but this will not be found to be the case if the midwife acquires the technique so thoroughly while a student that its methods become a matter of habit to her. That is what she must aim at ; she must try to reach the stage when she does not need to think whether she is doing the proper thing, but finds it comes automatically to her. By training herself in this way, it will become impossible for her to forget herself so as to use her clean hands to open a door or move the clothes without instinctively recognizing her mistake. At first she will have to be constantly on guard lest she make some error, but as she becomes educated in the methods she will find this tendency diminish, until the whole procedure is as simple to her as any of her daily duties.

She should take special care never to neglect the thorough cleansing with soap and water of her hands and arms and of her patient's external parts. There is no surer indication of the half-baked midwife or nurse than her placing her faith chiefly in chemical lotions and putting in the background the vulgar soap and water. Antiseptic solutions, however strong they may smell, are not to be thought of as a charm

to frighten away evil spirits in the shape of bacteria, but merely as an additional precaution after the more tedious and laborious scrubbing of the hands.

Finally, the greater the skill acquired in abdominal palpation the less the need for internal examination, and another sign of the " half-bake " is her reliance on vaginal examinations in order, as she terms it, to " try the pains."

Antiseptic Solutions and Disinfectants.

As it is the common practice in midwifery to combine both systems—to use the aseptic system wherever possible, for instruments, dressings, etc., and for the body to use a thorough cleansing, followed by the application of some chemical germicide, we will now consider the various solutions used for these purposes, and point out their special advantages and disadvantages, but before doing so reference will be made to the various ways in which heat may be used for purposes of disinfection.

Disinfection by Heat.—This may be done by (1) boiling, (2) steaming, (3) dry heat.

1. *Boiling* for ten minutes will render most articles sterile. Should the article be large and thick, a longer time, say twice that, is necessary, as it takes longer for the heat to penetrate to its centre. For instance, a thick roll of gauze would naturally require longer than a strip of the same material. Large metal instruments, like midwifery forceps, will lower the temperature of the water from the boiling-point, and care must be taken to see that the time they are left in the water is counted from the time at which the water is actually at the boil and not merely from the time the instruments are placed in the water. All instruments, douche nozzles, and catheters should be made of material which will allow of their being boiled, and they and all ligatures, dressings, and such-like should be sterilized by boiling or steaming before use. Care should be taken in boiling gloves to fill them with water and sink them. Otherwise the finger-tips may be burnt and softened against the cover or lid by the sterilizer or pan. Boiling is a method which is applicable anywhere where there is a fire or lamp and a pan or receptacle of some kind, and there are but few places where it cannot be carried out. Indeed, no place is suitable for a lying-in room where this cannot be done without difficulty.

2. *Steaming* is not of practical use in the ordinary house, but is used for sterilizing dressings, bedding, and clothing in special sterilizers. Sterilized dressings in sealed tins and boxes prepared in this way are often used at operations and lying-in cases.

3. *Dry heat* is not generally applicable, as it tends to scorch and destroy the material and does not penetrate into the centre of articles as boiling water and steam do. The scorching of the piece of linen used as a dressing for the umbilical cord is an old-fashioned method of sterilization by dry heat.

Disinfection by Chemicals.—There are a large number of substances used as chemical germicides, but only those in most common use will be mentioned.

1. *Mercurial Salts.*—Two are in common use, the perchloride (corrosive sublimate) and the biniodide of mercury. The double cyanide of mercury is used in the preparation of " cyanide " gauze but not for ordinary use as a disinfectant.

The two mercurial salts mentioned above are the strongest germicides known, and under favourable conditions destroy or prevent the growth of all bacteria and their spores. They are not generally used stronger than 1 part in 1000 of water and are carried in tablet or " soloid " form or in powders of $8\frac{3}{4}$ grs., so that one soloid or powder added to a pint of water makes a solution of 1 in 1000. If used internally or as an application to the eyes, solutions as weak as 1 in 2000 to 1 in 5000 may be ordered. Provided the skin is thoroughly washed with hot soap and water, so as to remove all greasy matter and dirt and allow of thorough penetration by a 1 in 1000 solution, these mercurial solutions are the most effective disinfectants we have. They are not generally harmful to the skin, but if the hands are being constantly immersed in them the nails become dark and cracked, and the skin sore. Some people are more susceptible than others to these skin effects, and as rough hands are a source of danger, the midwife who finds mercurial solutions hard on the hands must try some other method of disinfection. There are other

objections to these solutions. Metal instruments, especially if nickel-plated, placed in them are injured by a deposit of mercury, and metal vessels not enamelled are affected in the same way if the solution is made or kept in them. Albuminous substances are coagulated by the solution and form an insoluble combination, rendering the solution inert. Hence blood, pus, and discharges destroy their effect. Soap also forms a precipitate with mercurial solutions, so that it is useless and indeed impossible to wash in them. But by far the most serious objection to the use of such solutions is the extremely poisonous nature of the mercurial salts. Hence the midwife should never use them for douching [1] or other internal application or for application on dressings to raw surfaces from which absorption may take place. It is rare to use even as weak a solution as 1 in 2000 for repeated douchings, and great care must be taken that all the fluid is returned and none retained in the vagina. That is why it is important in giving a mercurial douche to express all fluid by pressure above the pubes at the end of the operation. Another and safer plan is to wash out all the mercurial solution by a douche of simple boiled water or boracic acid solution given immediately after the other. The midwife, knowing the danger of these substances, must be specially careful not to leave tablets or powders or solutions in patients' houses. The tablets are commonly coloured blue as a warning of their extremely poisonous nature, but in a poor light this may not be recognizable, and to children the colour may suggest a coloured lozenge or sweet of some sort. Generally these tablets are carried in special fluted dark-coloured bottles, and the midwife must take every possible precaution to guard against these tablets falling into other hands than her own. Each tablet usually contains $8\frac{3}{4}$ grs. of the perchloride of mercury, and the full dose of this substance taken internally is only one-eighth of a grain, so there are about seventy full doses in one tablet. Should a tablet be taken in error or any of the solution prepared for the hands, the only thing is to get a doctor at once and meantime to administer a large quantity of white of egg in water, which will form an insoluble albuminous compound with the mercurial salt. When a mercurial douche or mercurial applications are ordered, the midwife must be on the watch for symptoms of mercurial poisoning. Generally the first thing that occurs is gastro-intestinal irritation, shown by griping pains in the bowels, colic, diarrhœa, and sickness. Mucus and blood may be passed in the motions. A coppery or metallic taste is often noticed in the mouth, the gums and teeth become sore, and a red line is noticed round the gums just below the teeth ; there is a profuse secretion of saliva, the mouth becomes foul and the breath offensive. In severe cases the urine is scanty, thick, and may contain blood, and the patient's general condition rapidly becomes serious.

The perchloride of mercury is more generally used than the biniodide, though the latter has many advantages. It is not so liable to cause poisoning and is not so severe on the skin of the hands, nor does it affect metal instruments so quickly. No doubt the greater expense of the biniodide has prevented its wide adoption, but its greater tendency to absorb moisture from the air and become partially fluid is another reason. On the whole, it is a better and safer antiseptic, and, if kept in small closely-stoppered bottles, will be found to have many advantages over the cheaper and more commonly used perchloride.

2. *Carbolic Acid* (*Phenol*) is not often used for douches or internal use, but is sometimes used for instruments and dressings in a strength of 1 in 20 to 1 in 80. To prepare these strengths an ounce of carbolic acid is taken and water added to make up a pint of solution for a 1 in 20 solution, water to two pints for a 1 in 40, to three pints for a 1 in 60, and to four pints for a 1 in 80 solution. In making the solution the carbolic acid, being an oily fluid, must be carefully mixed ; therefore it is best to add sufficient boiling water slowly to the ounce of acid and mix it well till all the oily globules have disappeared, and then to make it up to the required strength by the addition of water. It is not conveniently used in tabloid form and must be carried as a liquid, which, however, readily solidifies in cold weather, in which case it must be warmed in front of the fire before use. It is very corrosive,

[1] An exception is made only in cases of purulent vaginal discharge noticed when the patient is in labour and medical assistance, which the C.M.B. orders in such cases (E 21 (3)), may not arrive till the labour is too far advanced (p. 327) to permit of a thorough disinfection.

and a drop on the skin makes a white burn, and hence is not a good antiseptic for general use by the midwife. It may sometimes give rise to poisoning when used internally. The passage of green-coloured urine is an indication of the absorption of carbolic acid. Carbolic acid solutions make the hands rough and therefore more difficult to cleanse ; hence it is generally used only for instruments, which it does not affect.

3. *Lysol, Cyllin, Creolin,* and other tar products belong to the same group as carbolic acid, but are less poisonous and hard on the hands, and are frequently used in a strength of a drachm to the pint or quart. Lysol is the most used, as it is soapy and a lubricant. None of them are very reliable because they vary in strength.

4. *Permanganate of Potash* is useful in destroying odours and in being non-poisonous, but its disinfecting powers with virulent organisms are too slight to make it advisable for general use.

5. *Boracic Acid* is another mild non-poisonous antiseptic ; it is used for eye washes, mouth washes, and vaginal douches, but it is not a powerful germicide. An ounce dissolved in a pint of water makes a good solution.

6. *Tincture of Iodine,* 1 drm. to the pint, makes a very good disinfecting solution. It is a powerful antiseptic, and used with hot water the iodine is given off as a vapour and penetrates deeply into the tissues. It is therefore very useful in douches, and used in this way is non-poisonous. It is also frequently used for the disinfection of the skin and vulva by direct application of the undiluted tincture to the surface.

7. *Formalin,* 1 in 100 to 1 in 1000, is also a very powerful and penetrating disinfectant, but it is not used as often as its good antiseptic qualities deserve.

Reference has already been made to care with poisonous mercurial preparations. This care must be extended to include all poisonous substances and medicines. The midwife should keep all disinfectants and other material for external application apart and in a different cupboard from these for internal use, such as aperients, pills, etc. Also both should be kept under lock and key, and all the labels should be distinct. Caution is particularly required when replenishing bottles in the bag from stock, as cases have occurred when strong disinfectants or acids have been poured into the bottle for eye-drops, with serious consequences.

The Midwife's Bag.

The bag should have two detachable and washable linings, so that one can be cleaned while the other is in use, or the bag may not be a bag at all, but a basket or a tin case. Indeed the last has many advantages, especially in the ease with which it can be kept clean, and that part of it may be used as a tray for instruments, etc.

It should contain the following articles :

An apparatus for vaginal douching.—The douche can and tube is the best for this purpose, but if that is not carried the Dublin syphon-tube may be used or a large glass funnel, which can be kept full from a jug. The Higginson syringe is not satisfactory, but may be used for want of a better, provided it has a glass nozzle and is kept solely for vaginal douching and not used sometimes as an enema syringe and sometimes for vaginal injections. An extra glass nozzle ought always to be carried in case of breakage.

An enema syringe.—The ordinary Higginson is the best.

Rubber gloves, soft rubber catheter and a glass or metal catheter, scissors, artery forceps, spring forceps, glass measure, clinical thermometer, and bath thermometer.

An enamel kidney dish, bowl, and a graduated jug will be found very useful if they can be carried conveniently. Catheters, nozzles, scissors, etc., can be boiled in the kidney tray.

A mackintosh and mackintosh apron will be found useful ; a case containing soap and nail-brush is essential for district work.

The *antiseptics* commonly carried are biniodide or perchloride of mercury in soloids for hands, etc., and lysol or cyllin for internal use (douching).

The *drugs* required are castor oil or other suitable aperient, liquid extract of

ergot (which ought to be freshly prepared), a sedative, such as tincture of opium or chloral hydrate (p. 303).

The minimum requirements of the C.M.B. are thus given in the regulations E 3) :

" A midwife must always have in her possession and take with her when called

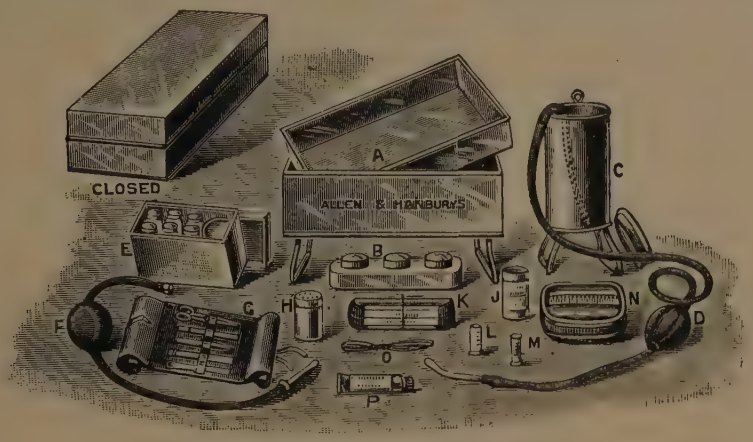

Fig. 68.—Midwives' Case (Allenburys).

(Closed case measuring 14½ in. by 6½ in. and 4½ in. deep.)

A. Sterilizer, forming the outer case.
B. Spirit lamp with three burners.
C. Douche can, to hang or stand, to hold one quart.
D. Rotunda douche.
E. Tin box containing six bottles, including eye-drop bottle and medicine measure.
F. Sterilizable enema syringe, with glass rectal tube.
G. Waterproof pouch containing scissors, dressing forceps, clinical and bath thermometer.
H. Powder dredger.
J. Carton of plain sterilized gauze.
K. Packet of iodoform gauze.
L. Minim measure.
M. Glass reel.
N. Nickel case containing nail-brush and soap.
O. Hanks of thread.
P. Biniodide vaseline in collapsible tube.
Vaginal tube, catheters, etc.

A washable khaki cover with straps and handle for carrying is provided ; the contents can be varied to suit individual requirements.

to a confinement a metal case or a bag or basket kept for professional purposes only and furnished with a removable lining which can be disinfected, containing :

" (*a*) An appliance for giving vaginal injections, a different appliance for giving enemata, a catheter, a pair of scissors, a clinical thermometer, and a nail-brush.

" (*b*) An efficient antiseptic or efficient antiseptics for such purposes as—(1) Disinfecting the hands ; (2) douching in special cases ; (3) cleansing the infant's eyelids."

CHAPTER XIII.

THE MANAGEMENT OF NORMAL LABOUR.

The midwife should go to her patient as soon after receiving the call as possible, and especially if the patient is one whom she has not examined before or has not seen recently. Many dangers to mother and child may be avoided if abnormalities and complications are detected early and the doctor called at once. She should take with her the bag fitted out as already mentioned.

If she is seeing her for the first time, she must satisfy herself that the patient is pregnant, that labour has commenced, and that it is normal. She will therefore begin by obtaining the history and then carrying out the abdominal and vaginal examinations as described. If everything is straightforward and the woman is in labour, the midwife must next decide whether it is necessary for her to remain or whether she can leave for a time. It is not always easy to settle this question, and it can often be done only by experience and by watching the patient for a sufficient time to enable some estimate to be made of the rate of progress. It is, therefore, a good plan for the midwife to arrange the room and bed and make all the necessary preparations for labour before coming to a decision, and in the meantime to make careful note of the character, frequency, and duration of the pains. It is always wiser to err on the side of caution and remain several hours unnecessarily than that the child should arrive in her absence. A primipara with an os less than five shillings can safely be left for a few hours unless the pains are very strong and frequent, but the midwife must remember that she cannot decide what the pains are like in a brief visit occupied in examining the patient. A multipara, and especially one that has had easy labours before, can never be left without risk once labour has well begun. The leaving of a patient must be largely determined by the midwife's being within easy call, and the C.M.B. lays down the rule that she " must not leave the patient without giving an address by which she can be found without delay " ; and " after the commencement of the Second Stage, she must stay with the woman until the expulsion of the placenta and membranes, and as long after as may be necessary " (E 7). The preparation of the lying-in room is a matter which ought to have been seen to beforehand,[1] and if this has not been done it is inadvisable to do much once labour has begun, as it only means filling the air with dust. Thus dusting, removal of curtains and valances, and shifting of furniture will only stir up and distribute the dirt and dust that would be better left lying where it was. If the room is so full that it is necessary to remove some articles of furniture, those which can be moved with the least disturbance are to be selected.

When possible the following articles should be provided : two washhand basins, one to wash the hands in and a second for clean water to rinse the soap off the hands ; a smaller basin to contain an antiseptic solution for the hands and swabs ; a pail or footbath to receive the discharges, soiled swabs, etc. ; a small table or wooden chair near the bed, on which should be placed the bowl of antiseptic solution with swabs. A jug, or, better, two jugs of boiled water covered with a clean towel should be prepared, and a plentiful supply of boiling water. A single iron bedstead is to be preferred, but the midwife rarely has any choice in the matter, so the best must be made of what there is. If the bed sags towards the middle, the leaf of a table, or boards under the mattress, are a great advantage in preventing fluid

[1] E 1, C.M.B. Rules, says : " When engaged to attend a labour the midwife must interview her patient . . . to advise as to personal and general arrangements for the confinement, and, with the consent of the patient, visit the house."

running into the bed. If there is a carpet, it should be protected at the bedside by a piece of oilcloth or sheets of brown paper or newspaper.

Two mackintosh sheets are required—one to protect the mattress is laid along the right side of the bed and over this a blanket; above the blanket the other mackintosh sheet is arranged so that it hangs down into the slop-pail for the discharges, and is covered with a draw-sheet, and if it can be obtained, a wood-wool accouchement sheet.[1] In many cases, where these requirements are not forthcoming, the midwife will have to improvise protection for the bed with bits of linoleum, brown paper, newspaper, or other makeshift, but she must keep in mind the importance of anything of which the cleanliness may not be above suspicion being kept from direct contact with the patient.

Where the domestic arrangements permit of it, the patient should be given a hot bath and the vulva and surrounding parts well washed. If a bath is not possible the midwife must wash the vulva and surrounding parts thoroughly with soap and water as described in the previous chapter.

The importance of a complete evacuation of the bowels has already been mentioned. Unless the patient has already taken one, a good purge should be given, and nothing is better than an ounce of castor oil. It is important that the oil should act thoroughly and promptly, and too small a dose may cause frequent small actions. Should the oil not have acted in three or four hours, or should the patient be too far advanced in labour to allow time for a purge to act, then a simple enema of soap and water should be given.

The patient is best clothed in a clean night-gown, pinned up over the shoulders to keep it from being soiled, a flannel petticoat, and a dressing-gown. In practice among the poor, the midwife must make use of what the patient can provide, but, so far as possible, clean washing garments are to be used.

First Stage.—Once the midwife has satisfied herself that everything is normal there is little for her to do during the first stage of labour beyond keeping her patient under careful observation. The pulse, temperature, and general condition of the patient, and the character, frequency, and duration of the pains must be noted at intervals. The patient should be reassured by being told that all is well and that matters are progressing favourably. In the ordinary vertex presentations she will do best walking about the room, because the weight of the bag of waters pressing down on the os helps dilatation and acts as a stimulus to uterine action. She must not be allowed to bear down, as that is useless and merely wastes her strength, and may cause early rupture of the membranes; and if this stage is at all long, she should be encouraged to take light food, especially hot fluids, but all forms of alcoholic stimulant are to be avoided. Sometimes rubbing the back over the sacral region or firm pressure by the hand comforts the patient. If she has been kept awake all night by occasional pains, and is tired, it is best to let her lie on the bed and try to sleep between the pains. The midwife ought not to forget to see that the bladder is emptied frequently, as its distension interferes with uterine action. Sometimes patients pass small quantities of urine at frequent intervals or have constant dribbling, because the bladder is overfull and cannot be emptied completely, hence a watch should be kept on the abdomen to make sure that there is no distension of the bladder.

Mental conditions have a great influence on uterine activity, and so far as possible the midwife must keep her patient from any disturbing or distressing influences. Hence the room must be kept free from officious friends and neighbours, and nothing must be said or done likely to disturb the patient's peace of mind. Encouragement and helpful words by a tactful attendant will do much for the patient. All meddlesome interference should be avoided and only the absolutely essential examinations made. The more experienced the midwife, the fewer vaginal examinations will she make. They should not be made as a routine. In a straightforward case none is required, and vaginal examination should be reserved for cases not previously investigated as part of the antenatal supervision, when the midwife is uncertain of the diagnosis by abdominal examination or there is delay or suggestion of complication. Should a rush of liquor amnii follow the rupture of the membranes, and especially if the patient is on her feet at the time, an examination should

[1] Obtainable at cheap rates, or free for the necessitous, from some local health authorities.

be made at once to make sure that the cord has not prolapsed. When the head has early sunk deep into the pelvis so as to fill up the cavity, and when the waters break late and leak away slowly, examination is superfluous unless the labour is delayed. "No more internal examinations should be made than are absolutely necessary" (C.M.B. Rules, E 9).

Second Stage.—At the end of the first stage the pains increase in strength and frequency and are accompanied by bearing-down efforts. The patient holds her breath and strains, and will probably wish to lie down; it is time that she did so, for the bearing-down efforts will now help the delivery, and the midwife must prepare for the birth. The patient should lie down on the place prepared, with her feet against the end of the bed, and be given a towel fastened to the bed to pull on. This stage of labour is best conducted with the woman on her left side with the body lying partly across the bed so as to bring the buttocks to the edge, the legs being drawn up. In this position it is easy for the attendant to watch the vulva during a pain and look for the distension of the outlet and appearance of the head at the vulva, showing that the birth is imminent. If the pains are very strong and the head is distending the outlet rapidly, the towel must be taken away and the patient's feet moved from the end of the bed, and she should be told not to hold

Fig. 69.—Delivery of the Head.

Flexion is maintained by pressure upwards with the thumb, whilst the fingers on the occiput lever it out below the symphysis. A pad is kept over the anus (in this case by an assistant) to prevent soiling by the escape of matter from the bowel. (From a photograph.)

her breath and strain but to breathe deeply and cry out. A pillow may be placed between her knees and the midwife must give her entire attention to the delivery, and especially at this moment to the care of the perineum.

There are three principles to be kept in mind in preventing perineal rupture:

1. To prevent the head coming through too rapidly.
2. To keep the head well flexed until the occiput is born.
3. To try and deliver the head between the pains.

The distension of the perineum stimulates the uterus and frequently the head is forced out by a storm of pains, the patient bearing down hard all the time. Hence the perineum may not have time to stretch properly. When the occiput is born, the nape of the neck is under the pubic arch, so that as the head emerges, first the sub-occipito-bregmatic ($3\frac{3}{4}$ inches) and then the suboccipito-frontal (4 inches) diameters occupy the vulval opening; if, however, flexion is incomplete or extension occurs too early, when the occiput is under the pubic arch, the occipito-frontal diameter ($4\frac{1}{2}$ inches) will stretch the outlet, and this longer diameter is sure to cause rupture unless the parts are very relaxed. If the head can be delivered between the pains, it can be eased out gently at a time when the patient is not straining and when the perineal muscles are relaxed, and so give the best chance of avoiding laceration.

These principles can be applied in practice in the following way. Taking away the towel and moving the patient's feet so that she has nothing to press against, and telling her to call out, will prevent the additional force of bearing-down efforts; the only trouble is that often the woman can scarcely help straining at the moment of birth. At the same time, by pressure on the child's head with the hand, the attendant can increase the resistance to its advance until the pain has passed off. Facing the vulva, the fingers and thumb of the right hand are placed on the head, the thumb over the forehead and fingers on the occiput; the thumb keeps back the forehead while the fingers hook the occiput out below the pubic arch (Figs. 69 and 70); this leaves the left hand free to exercise pressure on the fundus or to ease the head out between the pains by pressure on the chin through the perineum as soon as the occiput is free.

Another method is carried out by the midwife sitting on the edge of the bed just behind the patient's buttocks and facing the foot of the bed, her left hand being

FIG. 70.—DELIVERY OF THE HEAD: LATER STAGE.

The head is just about to escape. The thumb is keeping back the forehead, whilst the fingers ease out the occiput. As soon as the occiput is born and the nape of the neck below the symphysis, extension will occur and the forehead and face escape over the perineum. The pad held over the rectum by an assistant is drawn back to show the anus gaping from the distension of the perineum. If the assistant's hand was raised a little so that the anus was the mid-point between the thumb and fingers, it would be in position to ease the head out between the pains. (From a photograph.)

passed over the patient's abdomen and between the thighs, so that the fingers can control the head as it emerges. The action of this hand is at first to keep back the forehead by firm pressure on the part of the head that is coming over the perineum and so allow the occiput to get well in advance, and then when the occiput is born and the nape of the neck under the pubic arch, the fingers draw the forehead up towards the pubes. At the same time the right hand is arched over the perineum, so that the child's head is grasped through the perineum between the thumb and fingers. At first the right hand pushes the head up towards the pubic arch, so as to keep the wide biparietal diameter as far forward as possible, and when the occiput has passed below the pubic arch it assists extension by pressing the forehead up and out, and slipping the perineum back over the head. Should the head be forced out very rapidly, the palm of the right hand may be placed over the vertex and pressure made upwards and forwards so as to take the strain off the perineum and make the neck hug the pubic arch closely.

Without an anæsthetic it is not always easy to deliver the head between the pains, but the attempt to carry it out is done as follows. At the height of a pain,

when the head is just about to emerge, the patient must cease from all bearing-down efforts and firm pressure be made by the hand on the vertex to keep the head back till the pain is over. As the pain begins to go off, the hand behind the anus holds the forehead and face by firm pressure between the fingers and thumb. This keeps the head from slipping back as the pain passes off. Then the forehead is pushed slowly forwards and upwards so as to cause extension of the head, the left hand aiding this by drawing the head forward. If this is not sufficient to lever the head out, pressure must be applied to the fundus, preferably by an assistant. Sometimes in a primipara the delivery of the head may be brought about by a strong bearing-down action in the interval between pains.

As soon as the head is born a finger is passed up above the occiput to feel if the cord is round the child's neck; if it is, a loop should be gently pulled down over the head or slipped over the shoulders so that the child can pass through it. In rare cases, when it is very tight, it may be necessary to divide it and ligature the end next the child—this end is the one that can be felt to pulsate and from which blood will squirt—or clamp it with forceps. The cord left tight round the child's neck is not only compressed so as to stop the circulation through it and cause suffocation, but if it is short it delays the birth or may cause the placenta to be torn off the uterus. The child's eyes should be carefully wiped with pledgets of sterile cotton-wool or wool wrung dry out of 1 in 1000 perchloride of mercury lotion. As this is done before the eyes are opened a solution of this strength can safely be used. A separate swab is used for each eye and all secretion wiped away from the margins of the lids before the eyes are opened. This is a very important precaution in the prevention of infantile ophthalmia, and the C.M.B. make a special rule that "as soon as the child's head is born, and, if possible, before the eyes are opened, its eyelids must be carefully cleansed" (E 16).

The left hand must now be placed on the fundus of the uterus to watch for the pains which will expel the body and to follow the retraction of the uterus as the child is born. With these pains external rotation of the head will occur and the shoulders will rotate into the antero-posterior diameter of the outlet, and then the posterior shoulder will slip over the perineum and the body will follow, bending round the symphysis. The child's head ought therefore to be lifted up towards the mother's abdomen in order to prevent the posterior shoulder straining the perineum. If there is prolonged delay in the birth of the shoulders, and the child's face becomes dusky, an attempt to get the body delivered is made by rubbing up a contraction and getting the patient to bear down, or by firm pressure downwards on the fundus. It is important that external rotation should be complete and the shoulders not come out oblique to the outlet, otherwise the perineum may be seriously lacerated or a slight laceration made into a severe one. If, therefore, increasing duskiness and gasping efforts indicate the necessity of hastening the birth of the body, the head should be gently rotated to the right or left in accordance with the mechanism proper to the position and a finger inserted into the vulva to assist rotation of the shoulders in the same direction, fundal pressure meantime being continued by an assistant. When once the shoulders have rotated, the next point is to effect the delivery of one shoulder before the other so as to avoid distending the outlet by the full width of the shoulders by allowing a smaller diameter than the bisacromial to pass. Usually it is easier to get the anterior shoulder born first. The head and neck should be depressed gently towards the perineum to liberate the anterior shoulder from behind the symphysis. If need be a finger can be passed into the axilla to assist delivery, traction being made by it and by the other hand on the head. Should the anterior shoulder be found tightly wedged behind the symphysis, the head should be raised by one hand while the index finger of the other hand is passed over the perineum into the posterior axilla and traction made, the head at the same time being drawn forwards and upwards by the other hand.

As soon as the child is born the nose should be wiped and any fluid squeezed out of it and the back of the mouth wiped out with a piece of clean rag on the finger. If the child does not cry at once, its back should be rubbed with the fingers or it should be gently smacked or flicked with a towel, and if this does not make it cry, it should be treated as described on page 286. The child's body should be wiped

free from discharges and care taken to see that it cannot get its hands up to its face and eyes. "New-born babies sometimes rub discharges into their eyes with their bare hands. When Rule E 16 has been complied with they must be carefully wrapped up to prevent them from rubbing their eyes with their hands" (C.M.B. Rules, p. 67 (*b*); C.M.B. for Scot., p. 64 (*b*)).

The child, lying safely near the mother, is now left for a short time, the attendant meantime keeping her hand on the abdomen to notice the condition of the uterus and to be ready to act should any excessive hæmorrhage occur.

Once the child has cried vigorously and expanded its lungs, the pulsation in the cord will begin to fail, first near the mother, until in a short time it can only be felt in the two or three inches near the child. As soon as the pulsation at a distance from the child has become feeble, or in any case after five or ten minutes, the cord should be ligatured and the child cut away. The object of waiting till the pulsation in the cord has ceased is that with the expansion of the lungs and the diversion of the child's blood from the placental circulation to the lungs, blood is drawn from the fœtal circulation in the placenta to the child and thus saved to it. The cord should be tied about an inch to an inch and a half from the navel; there is no object in having too long a piece of cord—it only means so much more dead matter to keep from putrefaction—all that is required is a sufficient length to allow a second ligature to be put on later should the first become loose, and enough length of cord to turn over conveniently in the dressing. A second ligature on the maternal end is not necessary as the mother cannot bleed from it, but it is usually done to prevent needless soiling from the leakage of fœtal placental blood. It is always well for the pupil to draw the slack cord out of the vagina and put the second ligature at the vulva, where it will be a guide to the separation of the placenta. The important ligature is the one on the fœtal end; generally it is of five or six strands of pack thread knotted at each end and sterilized by boiling; it should be tied firmly in a reef knot. The cord is cut with sterilized scissors and the end wiped to see that there is no bleeding. The child is then wrapped in a clean flannel receiver in such a way that it cannot get its hands to its face (C.M.B. Rules, p. 67 (*b*)) and put in a safe place.

Third Stage.—In the management of this stage, the procedure to be adopted is one which follows closely the natural phenomena as given in the chapter on the Physiology of Labour. The cardinal principle is that the attendant's attitude must be that of watchfulness only, until it can be recognized that the placenta has left the uterus and is in the vagina. If no untoward symptom occurs to necessitate active interference, nothing is done to disturb the uterus in its work of retraction and contraction; the separation and expulsion of the placenta from the uterus and the closure of the vessels in the uterine wall are allowed to take place gradually and completely, so as to minimize the dangers of postpartum hæmorrhage or retention of portions of the after-birth. As soon as there is distinct evidence that the uterus has got rid of the placenta and is firmly retracted, and that these dangers are, therefore, no longer to be feared, efforts are made to complete delivery of the placenta.

During the third stage the mother must have the midwife's entire attention; as soon as it is seen that the child is breathing properly and that there is no bleeding from the cord, no harm will come to it if left for the time being in a safe place. After the cord is cut it is best to turn the patient on her back, as the uterus can be kept under observation and any abdominal manipulation effected better in this position than when the patient is on the left side. The hand is placed on the abdomen and the uterus felt as a firm rounded body reaching nearly to the umbilicus; it is easily defined, and feels fairly broad, and occupies the greater part of the lower abdomen. The hand must be so applied as to control the fundus and not the anterior surface only; to do this the fingers should be sunk into the abdominal wall behind the uterus and the thumb in front, so that the fundus is contained in the palm of the hand.

So long as the uterus remains quite firm and does not increase in size, the hand must be left quietly in this position. It is there simply on guard to watch the uterus and discover what happens, and is not to be used to worry it into premature and inefficient contraction; no rubbing or kneading is to be done, as it is impossible for

the uterus to become distended with hæmorrhage without the controlling hand recognizing its large size and flabby consistence. A glance at the vulva from time to time will assure the midwife that there is no undue external bleeding.

FIG. 71.—EXPRESSION OF THE PLACENTA.[1]

This shows the placenta in the vagina and the left hand on the abdominal wall grasping the uterus and pushing it down on to the placenta. When the placenta was higher up in the vagina the direction of pressure would be directly downwards and backwards towards the hollow of the sacrum. When it has reached the position shown in the figure it will be evident that the pressure must be directed more forwards so as to push the placenta out into the right hand which is ready to receive it.

After a pause of from fifteen minutes to half an hour the pains of the third stage come on, and it is for them that the hand on the abdomen is waiting and watching. A few well-marked contractions will expel the placenta from the uterus, sometimes no further than the vagina, but if the patient bears down strongly at the same time it may be driven right out into the bed. If, as sometimes happens, the complete expulsion does not take place, the unassisted efforts of the patient will take a long time, owing to the relaxed state of the abdominal wall, and tire her needlessly, and therefore the midwife must try to recognize the signs which indicate the expulsion of the placenta into the vagina, so as to be ready to help when the right moment has arrived, for once the uterus has done its share of the work it is better that the placenta should be delivered as soon as possible.

How can the expulsion of the placenta into the vagina be recognized ?

There is usually a little gush of blood which has been expelled from the uterus with the placenta, and the second ligature on the cord, if placed close to the vulva, will be seen to slip down some 2 or 3 inches, or 2 or 3 more inches of cord may be pulled out from the vagina, when the placenta is expelled from the upper uterine segment. This lengthening of the cord gives a very simple indication that the placenta has slipped further down the genital canal, and may be adopted by the beginner until she is familiar with the abdominal signs and is able to depend on them alone. After a little experience,

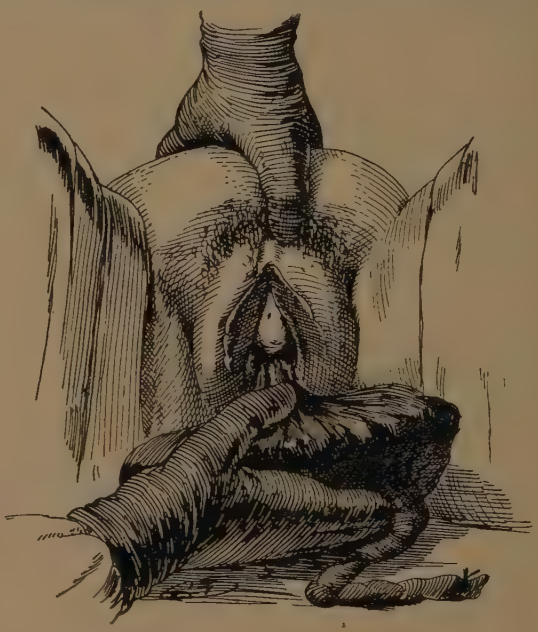

FIG. 72.—EXPRESSION OF THE PLACENTA.[1]

This shows the left hand grasping the uterus and the placenta expressed into the right hand with the membranes streaming after it. All that remains to be done is to complete the detachment of the membranes by roping them or by gentle traction downwards.

[1] These figures should be compared with Fig. 48, p. 106.

she will find that these are sufficiently distinctive to enable her to rely on them and to dispense with this measure. These signs depend on the changes which take place in the uterus itself, and are as follows :

1. The uterus becomes *smaller and harder* than it was before, stony hard like a cricket ball, owing to the strong retraction of its walls and to the absence of the soft mass of the placenta.

2. It feels *rounder*, because having got rid of the placenta it is no longer as broad as before.

3. It *rises up towards the abdominal wall*, becomes *more defined* and *more movable*, because it is now balanced on the top of the placenta and pushed upwards and forwards by it, and can therefore be more easily grasped in the hand, and moved from side to side. It rises to the level of, or just above, the umbilicus, and, when the abdominal wall is thin, the fundus may even cause a slight prominence in this region.

The presence of the placenta in the upper part of the vagina is said to cause the abdominal wall to bulge forward just above the pubes, thus simulating the appearance of a distended bladder, and providing another valuable sign. This appearance cannot, however, be depended on, as the placenta is expelled backwards in the axis of the inlet and so comes to lie in the hollow of the sacrum, and so can scarcely be expected to form a prominence above the pubes. When it does so, it is probably lying in the lower uterine segment and not in the vagina.

As soon as the midwife is satisfied that the placenta has left the uterus, the patient may be asked to deliver it by her own efforts, and if these fail it may now be pressed out from above. The patient should bear down strongly during a pain. By so doing she presses the contracted uterus down on the placenta and pushes it out of the vagina. Generally the relaxed state of the abdominal wall, caused by the stretching it has undergone during pregnancy, makes her efforts ineffective for some time, so that even two or three hours may elapse before she succeeds in delivering the after-birth, and therefore the attendant ought to save her this strain, by expressing the placenta for her. In doing this the fundus is grasped in the left hand, which is spread out over it, and the uterus when firmly contracted pressed downwards and backwards so as to drive the placenta down in front of it. As the perineum begins to be distended, the pressure is directed a little more forwards so as to follow the curve of the pelvic axis at the outlet, and the right hand is placed at the vulva to receive the placenta as it is born. Should the midwife have attempted expression before the placenta is completely expelled from the uterus, she will discover her error at once by the following indications. First of all, she will notice that the perineum does not bulge when she presses the uterus downwards, though the cord at the vulva slips down an inch or two farther. As soon as she ceases to press on the uterus, the cord will slip back into the vagina just as much as it had come out before, owing to the uterus pulling the placenta back with it as it returns to its former position after the pressure on it is withdrawn ; if the abdominal wall is lax enough to allow of it, the retracted uterus may be lifted up in the abdomen and the cord pulled up with it. If, on the other hand, the placenta is in the vagina, the cord will remain in the position outside the vulva to which it had been expressed, because. though the uterus goes back to its place, the placenta remains in the lower position in the vagina to which it has been brought by the attempted expression. If, therefore, the cord is permanently lengthened, further efforts at expression should be made, but if the cord slips back again as soon as the pressure on the uterus is relaxed, it is evident that the placenta is still grasped by the uterus and that it is useless to try any more for the present. The midwife must wait a little longer and look for the signs as described above ; should the placenta remain undelivered for two hours after the birth, medical assistance must be summoned, in accordance with the rule of the C.M.B. (E 21 (3)).

When the placenta falls into the right hand the membranes are stripped off the inside of the uterus by gently drawing them backwards in the axis of the pelvic inlet, *i.e.* in a direction towards the tip of the coccyx, or by turning the placenta round two or three times so as to twist the membranes into a rope. The after-

birth is then placed in a basin of cold water for subsequent examination and the hand replaced on the uterus so as to guard against any unexpected relaxation. It will be felt about the size of a fœtal head, very hard, and reaching to about midway between the pubes and umbilicus. As long as this cricket-ball hardness is maintained and no enlargement takes place, there will be no bleeding from the placental site. As soon as the midwife is satisfied that the uterus is well contracted and that there is no bleeding going on, she must begin her preparations to clean up her patient and make her comfortable. It is generally agreed nowadays that a vaginal douche is quite unnecessary after an uncomplicated labour ; its advantage in washing out the vagina is more than counterbalanced by the danger of introducing unclean matter into the genital canal. But dispensing with the douche does not mean that no attempt must be made to clear out all blood and clot from the vagina. Gentle expression should be made from the abdomen, just as was done for the expression of the placenta or to expel the last of the fluid after a douche, and in this way any blood and clot which may have collected in the vagina will be squeezed out. A basin of warm water with some clean wool in it should be placed on a chair on one side, and some lotion and wool on the other, and the hands carefully cleansed. The perineum should first be examined in a good light to make sure that there is no laceration ; in doing this it should not be forgotten that it is not only the skin surface which must be looked at, but the labia should be held apart with two little pads of wool from the lotion basin and a careful inspection made of the posterior vaginal wall, as this is the most common site for lacerations. By holding the labia apart in this way and looking into the vagina the extent of a tear can best be estimated ; any tear extending into the perineal muscles should be reported to the doctor. The C.M.B. rule reads : " In cases of rupture of the perineal body, or of other injuries of the soft parts."

The blood should now be washed from the vulva and thighs, especial care being taken to see that no clot is left entangled in the pubic hair ; the best way of ensuring this is to clip away the hair with scissors. The vulva should then be sponged over with lotion and dried with a clean towel, a wood-wool pad or diaper put on, and all soiled things removed from about the patient. The upper sheet and mackintosh are removed and a clean draw-sheet or wood-wool sheet put under her, care being taken to disturb her as little as possible. Her night-gown is now drawn down, or changed if soiled in any way, and everything seen to be dry and comfortable for her. The uterus should be examined again and the pulse rate and general condition noted. After a normal labour the pulse rate generally falls a little, to 70 or 80 beats or less, and a rate of 100 or over means that there is danger of hæmorrhage, or that the patient has already lost more than she ought, or that she is exhausted. In all such cases the midwife should keep a careful watch on her, looking frequently at the pad and examining the abdomen. Shivering fits at the end of labour are not uncommon, but need cause no anxiety if the general condition is otherwise good. Nothing has been said about the binder because that is to be looked on as solely for the comfort of the patient and not as a means of ensuring uterine contraction, as is often thought. The cases in which a binder is required for such purposes will be referred to elsewhere. If the patient is uncomfortable with a binder, there is no reason why it should be used ; most patients like the support which a binder gives to the relaxed abdominal walls, and hence it is better to put one on, and if it disturbs her then it can be left off. The best time to apply it is just before the patient composes herself for sleep, as this leaves the abdomen free for observation of the uterus till the last moment ; if there is bleeding or the uterus is flabby, the binder is best discarded till the midwife is satisfied that good retraction has occurred and all is well. One end of the binder should be rolled up and passed under the patient's back and the two ends brought over her abdomen ; the lower border should reach a little below the widest parts of the hips and be pinned firmly there so that it will not work up, and the middle part be pinned tightly so as to support the abdomen, while the upper part under the ribs is left a little looser.

If there has been free bleeding at any time during the third stage, or if the midwife has any reason to fear relaxation of the uterus, a dose of 1 or 2 drms. of the liquid extract of ergot may be given to promote contraction. Also a little warm

liquid nourishment may be given, as it helps sleep ; the patient should then be left, with the room quiet and darkened, to the rest she needs so much.

Before turning her attention to the child the midwife must make a careful examination of the after-birth to see that nothing has been retained. " The midwife in charge must in all cases of labour examine the placenta and membranes before they are destroyed, and must satisfy herself that they are completely removed " (C.M.B. Rules, E 10). The placenta is usually expelled with the fœtal surface outermost. It should first be turned into the position it occupied in the uterus, *i.e.* with the cord inside the bag and the maternal surface outwards. The membranes should then be looked at in the basin to see if they are complete, any missing part of the chorion being sought for, as if a gap in the chorion is found anywhere near the placenta with a leash of vessels running from it to the umbilical cord, it points to succenturiate placenta retained in the uterus (p. 63). The rough maternal surface of the placenta should be examined to see that all cracks and fissures in the surface fit into one another and that no part is missing. The best way to do this is to take it in the two hands so that it lies in the hollow formed by them, with the uterine surface uppermost ; if the hands are turned outwards and downwards the fissures will gape and be very easily seen, and if the outer borders of the hands are raised so as to make them into a cup, this will bring the fissures together and it will be easily seen if any portion is missing. Should there be any evidence of this, a notification must be sent to a medical man, and the after-birth kept for him to see (C.M.B. Rules, " When . . . the placenta has not been completely expelled ").

After the midwife has seen to the baby and before she leaves her patient, she should again satisfy herself that her patient is all right, and put a fresh pad to the vulva and note the loss on the pad removed. " The midwife must remove soiled linen, blood, fæces, urine, placenta, and membranes from the neighbourhood of the patient and from the lying-in room as soon as possible after the labour, and in every case before she leaves the patient's house " (C.M.B. Rules, E 11).

Before leaving the third stage of labour it will be well to discuss the method of treatment advised a little further, by explaining the objections to other methods which may have occurred to the pupil.

The reasons for waiting on the uterus have already been given, but it may be not quite plain why kneading and rubbing the uterus were discountenanced unless when it is flabby or bleeding is going on. It is because it may result in premature retraction of the lower uterine segment, especially if the rubbing is continued over the lower part of the uterus, thus causing what is known as " hour-glass contraction." This is brought about by the formation of a tight ring at the junction of the upper and lower uterine segments, which may result in the placenta being nipped in the ring or imprisoned in the upper uterine segment. Most of the cases of delay in the birth of the placenta which are ascribed to its being nipped in the cervix are due to this fussy rubbing of a normal uterus. More haste and less speed is a possible consequence of trying to hurry the natural powers. The reason why we wait till the placenta is in the vagina, is not only to allow time for complete retraction of the placental site, but also because all attempts to express the placenta from the uterus itself are as a rule futile. It has sometimes to be tried (p. 218), but if the pupil considers what would be the probable result of trying to squeeze the placenta out by pressure on the uterus, she will quite understand why it is not likely to succeed. An attempt of this sort would probably only result in pressing its walls together and holding the placenta between them.

The arguments against pulling out the placenta by traction on the cord are still more convincing. First, suppose the placenta is still in the uterus. If it is not completely detached the uterine wall may be pulled down, and if traction is continued the uterus may be pulled inside out or " inverted," and reference need only be made to the account of " Inversion of the Uterus " (p. 221) to learn what a serious accident this is. If the placental attachment is not firm enough to allow of this, portions of the placenta may be torn off and left attached to the uterus, and give rise to hæmorrhage or, later on, to sapræmia should the retained portion become infected. Even if the placenta is not adherent, the retraction of the placental site, which, as was explained on page 105, takes place last, may not be

complete, and the withdrawal of the placenta may be followed by serious post-partum hæmorrhage. Secondly, suppose the placenta is in the vagina. Here, again, traction on the cord is bad, though it may not have as serious consequences as if the placenta was still in the uterus. It is liable to lead to tearing of the membranes, so that part of them may be left behind, and it is mechanically a bad way of removing the placenta. The cord is usually attached to the centre of the placenta, so that the result of traction on it is to bring it crosswise to the vulval slit as a button is to a button-hole. It would be better to try by passing a finger into the vagina and hooking hold of its edge and bringing it out sideways, as a button is taken through a button-hole. The objection to this is that it is bad technique, as it leads to a risk of unclean matter being carried up into the genital canal with the fingers, and hence ought only to be employed after expression in the right direction has failed after repeated trial. Failure to effect expulsion by pressure from above is generally due to impatience and inexperience on the part of the attendant.

Rupture of Membranes.

The membranes generally rupture about the time of full dilatation, and the most favourable time for rupture to occur is shortly after full dilatation. Sometimes, however, the membranes rupture early in the first stage, at the very commencement of labour, or even before labour has begun. Early rupture is unfortunate, as the soft dilating wedge of the bag is lost, but the effect of the early rupture depends very much on the amount of water which drains away. If the vertex is presenting and there is nothing to interfere with its descent, the head will come down into the cervix and plug it, keeping back the hind-waters by its "ball-valve" action, thus preserving sufficient water to prevent injurious pressure on the child. The most troublesome cases are those known as "dry labours," where this does not occur and the water drains away while the os is but slightly dilated. This is obviously more common in cases of malpresentation, contracted pelvis, and such-like, but sometimes occurs in an otherwise straightforward delivery. It gives rise to feeble pains and slow dilatation, the condition known as "rigid os" being frequently present, and, naturally, the danger to the child is always greater as soon as the waters escape. The midwife should notify the doctor, stating, however, that there is no urgency. Special care must be taken to keep the patient quiet and undisturbed —for she is often nervous and excitable and naturally worried and anxious by the prolonged labour—and everything must be done to avoid interference with uterine action; the rectum and bladder must not be neglected, and if the os is felt to have a hard rigid edge, a douche as hot as the patient can bear, given slowly, under strict antiseptic precautions, may help its relaxation. Very often a sedative draught of 15 minims of laudanum (tincture of opium) or chloral (grs. xxx.) or an opium pill (gr. i.) is the most satisfactory treatment. The patient must be kept under close observation, and medical assistance summoned should it be a first labour, if there is any question of difficulty or warning of danger to mother or child.

Late rupture of the membranes rarely gives rise to trouble. It is said that the tougher amnion may separate from the weaker chorion and that portions of the latter may be left behind when the after-birth comes away, but there is little or no evidence that this is the case. Sometimes the unruptured bag will appear at the vulva and distend it. In primiparæ this is distinctly advantageous, and if the pains remain good it is best to allow the bag to bulge through the outlet before rupturing it, as this means that the soft bag will dilate the maternal parts for the head and make the labour easier. Frequently a result of the late rupture of the bag is a diminution in the strength of the pains, as the hard presenting part is a better stimulus to uterine action than the soft bag. If the pains go off or do not increase in strength after the os is fully dilated, it is best to rupture the membranes by pushing the finger through them when they are tense during a pain or to puncture them with some sterile instrument. In multiparæ with slack abdominal walls, when the head is late in engaging, it is often advisable to rupture the membranes even before full dilatation, to allow the head to come down into the os and complete the dilatation. At the same time it is well to warn the midwife against the merely

meddlesome rupturing of the membranes which is often practised by the ignorant attendant on the look out for something to do. Rupture of the membranes before the cervix is fully drawn up increases the chance of laceration of the cervix, more especially in primiparæ. The membranes ought never to be ruptured artificially unless there is a very definite indication, and, therefore, before doing so the midwife ought always to satisfy herself that one or other of the following indications are present :

1. In primiparæ, when the bag is bulging out through the vulva ; in multiparæ, when the os is fully dilated.
2. In primiparæ or multiparæ when the os is fully dilated and strong expulsive pains have not followed or labour is slow.
3. In multiparæ with lax abdominal walls, when the os is three parts dilated and the pains are feeble, especially if the head is late in engaging.
4. In certain complications (pp. 209 and 214).

Occipito-posterior Positions of the Vertex.

These positions may give rise to delay in labour from malrotation of the occiput, and require special consideration. Their recognition is important : early in labour this is only possible by abdominal palpation, but after rupture of the membranes when the head has sunk down and the os is dilated, the anterior fontanelle is low down and to the front and within easy reach on vaginal examination (Figs. 59 and 61). There are three points on abdominal examination which suggest a posterior position —(1) The small parts are particularly easily felt in front, the anterior shoulder being often recognizable between the umbilicus and the anterior superior spine on the same side as the back ; (2) difficulty in finding the back—the edge of the trunk only can be felt in many cases, and that most often on the right side, because the R.O.P. position is more frequent than the L.O.P. ; (3) the fœtal heart is usually heard with difficulty and far out in the flank. The last sign is especially valuable, as in the second position the maximum intensity of the heart sounds is rather nearer the middle line than midway between the umbilicus and the groin, and in the third position the heart sounds are commonly best heard right out in the flank. Sometimes evidence of extension of the head as described on page 120 may be obtained, but it is difficult to be sure of it with the back posterior. Should the occiput rotate backwards (Fig. 62) the second stage will be delayed, the vulval orifice gapes more than usual, and perineal lacerations are frequent. These effects are due to the longer occipito-frontal diameter ($4\frac{1}{2}$ inches) engaging the outlet instead of the shorter suboccipito-frontal (4 inches).

If discovered at antenatal examination, a folded towel making a thick pad should be placed behind (*i.e.* in an R.O.P.) to the right of the anterior shoulder and extending up that side of the uterus, over which is placed a tight binder. The bowels should be kept loose and the patient told to rest as much as possible, and to lie on the opposite side to the pad. Some cases will be found to rotate forwards. If not, the pad and binder should be reapplied till the head is fixed in the pelvis.

In the management of these cases the midwife should be prepared for a longer second stage than usual ; if forward rotation occurs, as it does in nine out of ten cases, the occiput has three times as long a rotation to perform as in the anterior positions, and if it is not fully flexed the head will occupy more room in the pelvis, and rotation will be delayed. Recognizing this the midwife will watch for signs of distress in the child, for quickening of the maternal pulse and other evidence of protracted labour (pp. 191 and 193) which will tell her that the time has come for medical aid. Meantime she can try to promote rotation forwards, as described for antenatal cases, by correcting uterine obliquity and pressing round the back. The patient should be kept on her left side till the head is well down into the pelvis and then turned on to the right side. The want of good flexion is the chief cause of malrotation, so another procedure advised is to keep back the forehead during a pain by pressing it up with the fingers and thus encouraging descent of the occiput. The objection to this is that it is not often successful and entails frequent internal manipulation, which is bad practice. Therefore it is best not attempted. Occasionally

neither the occiput nor the forehead rotates forward and the head descends in the oblique diameter, and is delayed by presenting obliquely to the vulval opening. Strong expulsive pains may force the head out if it is not too large, with, in all probability, extensive laceration of the soft parts, but as soon as the condition is recognized an effort should be made to assist rotation. The forehead should be pushed up and the occiput hooked down by a manœuvre similar to that described and illustrated on page 145, and then an attempt should be made to rotate the occiput forwards under the pubic arch as explained below.

FIG. 73.—MANUAL ROTATION OF THE OCCIPUT IN UNREDUCED OCCIPITO-POSTERIOR POSITIONS.

The head is gripped between the fingers and thumb and rotated in the direction of the arrow. The other hand on the abdomen pushes over the anterior shoulder so as to rotate the body.

As soon failure to secure forward rotation is shown by the occiput having gone backwards into the sacral hollow, or if the second stage has lasted two hours without forward rotation having occurred, medical aid should be sought.

If the doctor should be long in coming, an attempt may be made by the midwife to rotate manually. The head is gripped by the whole hand passed into the vagina—between the fingers and thumb—and the occiput rotated round the side of the pelvis to which it points ; at the same time the other hand on the abdomen pushes over the anterior shoulder towards the opposite side (Fig. 73). Unless the rotation of the body is effected, the internal rotation of the head will not be successful.

PART IV.—ABNORMAL LABOUR.

It is impossible to say exactly where normal labour ends and abnormal labour begins, or what should be included under the head of abnormal labour. The child normally ought to present by the vertex, but it will be seen that a breech delivery may be quite easy and straightforward, whereas a posterior position of the vertex, as described in the preceding chapter may give rise to a prolonged and difficult labour. The abnormal presentations will first be discussed, other causes of abnormal labour will be considered, including—(1) Cases in which the labour is protracted or precipitate, *i.e.* when it is prolonged abnormally or shortened abnormally; (2) cases in which the labour is complicated by hæmorrhage, fits, disease, or other abnormal condition of the mother.

Abnormal Presentations.

Under this heading will be considered other presentations than those of the vertex, and before commencing a study of the individual presentations it will be well to discuss the causation of abnormal presentations generally. The following are the chief conditions which predispose to their occurrence:

1. Contracted pelvis, or large size of the fœtal head.
2. Obliquity of the uterus and laxity of the abdominal wall.
3. Tumours of the uterus or pelvis.
4. Placenta prævia.
5. Twins.
6. Premature, dead, or malformed fœtus.
7. Hydramnios.

Of these the first five act by interfering with the easy engagement of the head; a contracted pelvis, and especially a flattened pelvis, detains the head at the brim and thus gives opportunity for change of presentation, and so also do pelvic tumours. Obliquity of the uterus results in the presenting part being directed against the sides of the pelvis, instead of into the inlet. In placenta prævia the mass of the placenta in the lower uterine segment also interferes with the descent of the presenting part. In twins the one fœtus may interfere with the other, and in hydramnios the excess of fluid allows of undue mobility, and so predisposes to irregular presentation. A small premature child is also very mobile; a dead child without tone and firmness will easily take unusual positions; malformations may interfere with engagement and with the ordinary position of the fœtus in the uterus.

It will be clear that until the head is fixed in the pelvis, malpresentation may occur when labour begins. Thus all cases in which antenatal examination has shown the head to be movable above the brim, should be seen at the onset of labour, for it is then that face and brow presentations and oblique lies may arise.

CHAPTER XIV.

FACE AND BROW PRESENTATIONS.

Face Presentations.

The face presents when the head instead of being flexed is completely extended. It occurs once in about 250 cases. The causes which are specially operative in producing face presentations are :

1. **Flattened Pelvis.**—There is always some extension of the head when it engages in a flattened pelvis ; the narrow frontal part (bitemporal diameter, $3\frac{1}{4}$ inches) can descend more easily than the broader biparietal ($3\frac{3}{4}$ inches), which is therefore kept back. Also the occipital protuberance may catch on the pelvic brim, and, the uterine action driving the head down, will cause the face to enter.

2. **Obliquity of the Uterus,** by directing the head against the pelvic wall instead of into the inlet will cause the occiput to hitch on the brim, and the uterine force will drive the face into the pelvis.

3. **Malformations of the Fœtus ; Anencephalic Fœtuses,** in which the vault of the skull is absent, have no vertex to present by and so generally present by the face ; fœtuses with very long heads, with tumours of the neck, or with very short cords, are likely to present by the face.

Positions of the Face.

The relation of the child's back to the front or back of the mother is the same in each position of the face as in the corresponding position of the vertex. In other words, the child is in the same position but with the head in extension instead of flexion. If the head in a first vertex is extended completely, the face enters the pelvis with the chin backwards and to the right. The chin is the denominator in face presentations, as the occiput is in vertex presentations, so the first position of the face is that with the chin backwards and to the right.

The Latin word for the chin is *mentum*, and the first position of the face is known as the right mento-posterior (R.M.P.). The pupil will easily follow what has been said on this subject if she takes the dolly and, directing the head obliquely into the pelvis in the L.O.A. position, hitches the occiput on the brim above the left foramen ovale and presses the head into the pelvis in complete extension ; she will then see that the extended head enters as R.M.P., *i.e.* with the chin backwards and to the right sacro-iliac joint. Similarly, the second position will be found to be left mento-posterior (L.M.P.), and so in the direction of the hands of the clock the third will be left mento-anterior (L.M.A.), and the fourth, right mento-anterior (R.M.A.). As in the vertex cases, the back of the child will be forwards and to the left in the first position, forward and to the right in the second, backwards and to the right in the third, and backwards and to the left in the fourth.

Mechanism in Face Presentations.

The attitude of the fœtus, instead of being one of general flexion, is that of extension of the head and back, with flexion of the limbs. The face enters the pelvis with the chin in advance, the submento-bregmatic (or the cervico-vertical) diameter engaging, *i.e.* a diameter from the neck below the chin to the bregma or the summit of the vertex.

The movements of the head in its descent are described as—

1. Extension.
2. Internal rotation.
3. Flexion.
4. External rotation.

Third Position (L.M.A.).

Extension.—The head enters the pelvis extended, *i.e.* with the occiput pressed firmly back on to the child's back, thus bringing the face into the brim, with the chin lowest. Place the head in the pelvic inlet with the face downwards, and in such a position that the chin is forwards and pointing to the left foramen ovale, *i.e.* the length of the face is in the right oblique diameter. Once extension has

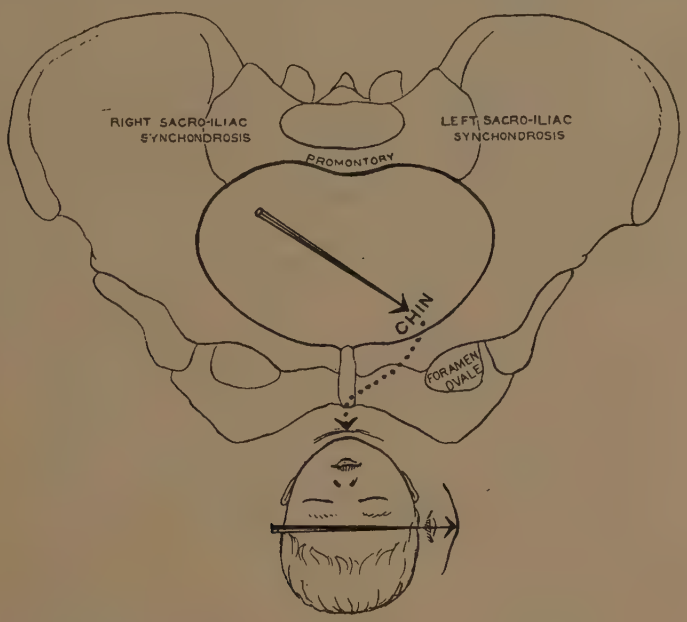

Fig. 74.—Third Position of the Face, L.M.A. Mechanism.

The face enters the brim in the right oblique diameter, as shown by the arrow, with the chin in front. By extension the chin goes down first and rotates one-eighth of a circle under the pubic arch, as shown by the dotted arrow. The head is then born by flexion, as shown in outline, and then the chin turns through two-eighths of a circle to the left (external rotation) as shown by the arrow.

begun, it will be increased as the face is pushed down through the pelvis by the uterine contractions, because the resistance of the genital canal has more leverage in keeping back the forehead than the chin, which therefore becomes the lowest point.

Internal Rotation.—As the head is pressed down the pelvis the face turns from the right oblique diameter in the cavity to the antero-posterior at the outlet; the chin moves from opposite the left foramen ovale to under the pubic symphysis, because, as in all mechanisms, the lowest or most advanced point which first meets the resilient pelvic floor is directed by it forwards to the open space under the pubic arch. The result is to bring the long diameter of the face into the longest diameter of the outlet—the conjugate.

Flexion.—When the chin has slipped out under the pubic arch, and the front of the neck lies behind the symphysis, the vertex occupies the sacral hollow, so that the outlet is distended by the submento-vertical diameter. As the uterine and auxiliary forces drive the head down on to the perineum, the perineum in turn forces the head upwards and forwards. After the chin, the mouth, nose, and fore-

head slip out, and as the head escapes in this way it is bent upwards over the symphysis—in other words, the extension of the head is undone and flexion produced—just the reverse of what occurred in vertex presentations.

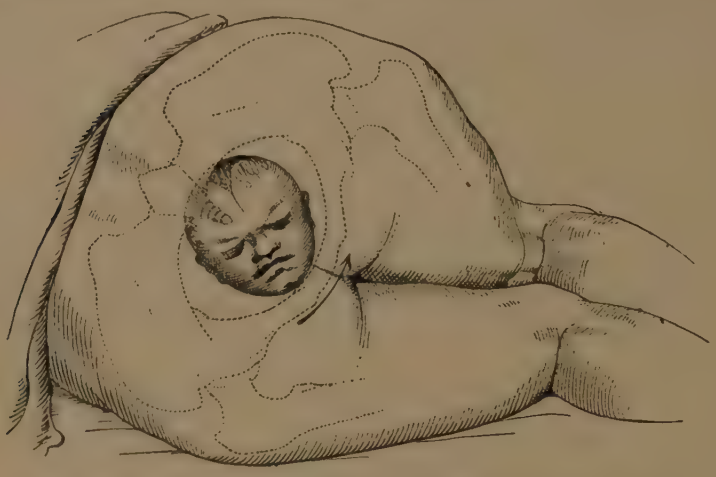

FIG. 75.—THE THIRD POSITION OF THE FACE (L.M.A.); VAGINAL EXAMINATION IN THE LEFT LATERAL POSITION.

The submento-bregmatic diameter is engaged in the right oblique with the chin forwards. The chin comes down in advance and is rotated forwards one-eighth of a circle (in the direction shown by the arrow) to under the symphysis pubis. The caput will be formed over the anterior eye and cheek—the left in this case.

External Rotation, as before, is really a movement of the unborn body of the child in which the head partakes. The shoulders which have descended in the left oblique diameter rotate into the antero-posterior at the outlet; the left shoulder, which is anterior and opposite the right foramen ovale, meets the resistance of the pelvic floor first, and therefore rotates under the pubic arch, the face turning towards the side the chin pointed to, namely, the mother's left. As in vertex cases, this movement is twice the length of the internal rotation, because it is made up of both restitution and external rotation. In other words, the internal rotation of the chin causes the head to be twisted one-eighth of a circle on the shoulders, because the shoulders cannot follow the rotation of the head; as soon as the head is born this twist is undone (=restitution) by the face turning one-eighth of a circle towards the mother's left; then as the shoulders rotate one-eighth of a circle, the face turns another one-eighth of a circle to the mother's left (=external rotation), making two-eighths of a circle of external rotation and restitution.

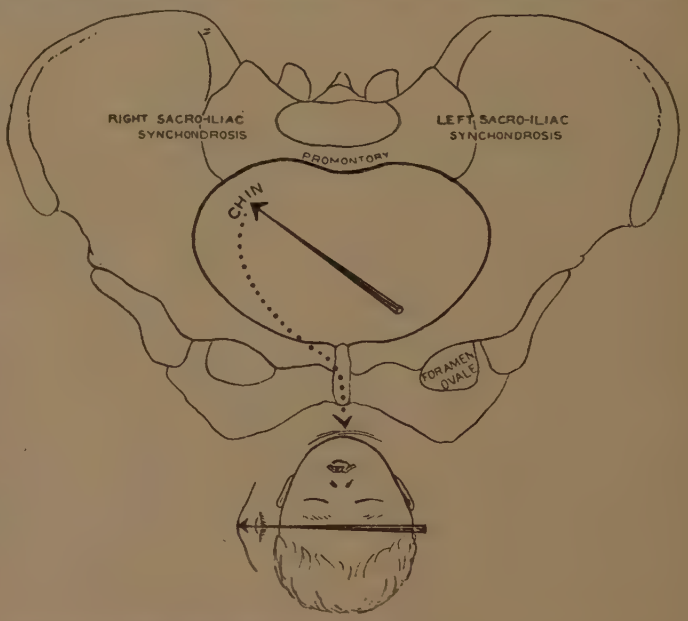

FIG. 76.—THE FIRST POSITION OF THE FACE, R.M.P. MECHANISM.

The arrow shows the submento-bregmatic diameter of the face in the right oblique with chin backwards. The long internal rotation of the chin to under the symphysis is indicated by the dotted line. The head, born by flexion with the chin under the pubic arch, is shown in outline. The lowest arrow shows the external rotation of the head through two-eighths of a circle, so that the chin points directly to the mother's right.

The expulsion of the trunk follows exactly as in vertex cases.

The mechanism in the fourth position, R.M.A., is just as in the third, except that right is substituted for left.

Mento-posterior Positions—Mechanism in the first (R.M.P.) and Second (L.M.P.) Positions of the Face.

These positions behave like the third and fourth vertex. The chin points to one or other sacro-iliac joint; the head enters the pelvis extended with the chin well in advance, so that it is the first point to meet the resilient pelvic floor, and is therefore rotated right round the side of the pelvis from the sacro-iliac joint to the symphysis pubic, making a long internal rotation of three-eighths of a circle. Thus the long diameter of the face (submento-bregmatic) rotates from one oblique diameter (in the first position, the right) to the transverse, then into the other oblique diameter, and from that into the antero-posterior at the outlet. After the face has rotated from one oblique diameter to the other the mechanism is the same as in mento-anterior positions.

Abnormal Mento-posterior Positions.

In first or second positions, when the extension is not sufficient to bring the chin well in advance, the long internal rotation through three-eighths of a circle

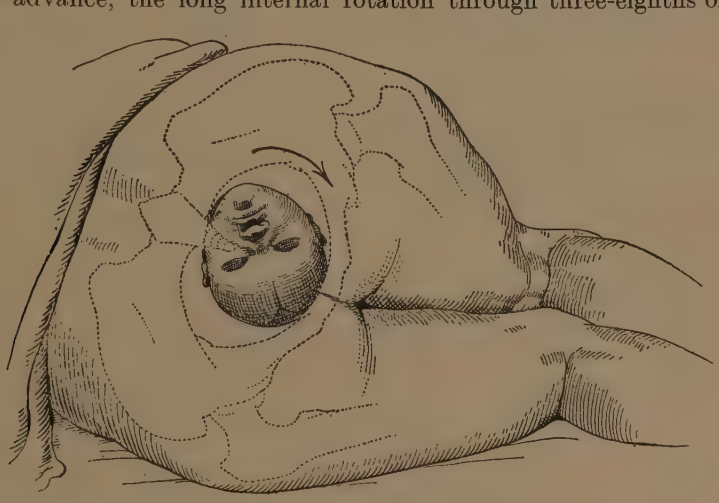

Fig. 77.—The First Position of the Face (R.M.P.); Vaginal Examination in the Left Lateral Position.

The face in the right oblique with the chin backwards; the back of the fœtus forwards and to the left. The chin is in advance and undergoes internal rotation through three-eighths of a circle in the direction shown by the arrow to under the symphysis. The caput is formed on the anterior cheek and eye—in this case the right.

forwards may not take place; instead, the forehead will make the short rotation of one-eighth circle forwards to behind the symphysis and the chin backwards into the sacral hollow. This movement is precisely similar to the persistent or unreduced occipito-posterior mechanism in the third and fourth vertex positions, and is known as the *unreduced mento-posterior*. It is, however, a much more serious condition than the unreduced occipito-posterior. Unless the head is small, the pelvis roomy, and the uterine contractions strong, the head will become impacted in the pelvis. If these conditions are present the top of the head may be squeezed out underneath the pubic arch, and the chin slip over the perineum, and the head be born by flexion, but usually the case becomes one of obstructed labour, owing to the shoulders being wedged into the pelvis with the head and forming an immovable mass impacted in the cavity. In any case, when the chin is in the hollow of the

sacrum and the vertex pressed against the back of the symphysis, the maximum vertico-mental or a diameter near to it is thrown across the pelvis, and such a diameter is too large to allow of the delivery of an ordinary-sized head.

Advice to the Pupil in Studying the Mechanism of Face Cases.

In learning these mechanisms, the dummy fœtus or dolly is better for ordinary purposes than the fœtal skull, as the relation of the head to the body is more easily seen, but the skull ought to be used with it, to accustom the pupil to showing this mechanism with the skull. As in the study of all mechanisms, the movements must be followed by putting the head and dolly through the pelvis ; they cannot be understood from books and diagrams only. Begin by hitching the occiput on the pelvic brim and seeing how the flexion of the head is changed into extension, thus converting the vertex presentation into one of the face, and note to what position of the face each vertex position is changed. Having observed the positions and the diameters engaged, go through the mechanism of each position as described, and carefully note the way in which the head and shoulders become jammed in the pelvic cavity when the chin is rotated backwards. The effect of the pressure in moulding the head will be seen ; the maximum pressure will be on the submento-bregmatic diameter, and this will, therefore, be diminished in length, the occipital and frontal ends of the head thus bulging out and increasing the occipito-frontal diameter.

Diagnosis of Presentations by the Face.

Abdominal Examination. — The child will be found in the long axis of the uterus, *i.e.* not a transverse lie, and with the head below and the breech in the fundus. In other words, it will be a cephalic or head presentation, and the problem will be to decide whether the head is flexed so that it is a vertex or whether the head is extended and the presentation is a face. The following points are in favour of a face presentation. The head is more likely to be above the brim and to be freely movable ; this may be due to the primary cause of the face presentation, such as contracted pelvis, or to the greater difficulty in the engagement of the extended head when the face presents. If there is some degree of pelvic contraction, the face will lie in the transverse diameter at the brim, and the occiput, being the highest part of the head, will form a marked prominence on one or other side. The chin, on the other side, if it can be felt, is described as being like a small horseshoe or hoof, but it generally has sunk so far into the cavity that this sign is rarely made out. If it is felt, it suggests incomplete extension and a brow presentation (p. 161). In the dorso-anterior positions (first and second) the back is not so easily felt below the umbilicus as in vertex cases, owing to its extension not bringing it close up against the uterine wall, but above the umbilicus the lower part of the back and the breech are generally very prominent and easily recognized. If the prominence of the occiput is recognized, a gap will be felt above it before the back can be made out, then when the back is felt running up into the breech, the breech will be found on the same side as the prominent occiput. The small parts are not easily felt. In dorso-posterior positions (third and fourth) the extension of the spine brings the limbs forward against the uterine wall so that they are very easily felt, while the back cannot be mapped out, and in cases in which the chin can be felt above the pelvic brim, it will be on the same side as the fœtal small parts.

The one important point in auscultation is, that the fœtal heart is best heard on the same side as the small parts of the child—owing to the chest being thrust forward by the extension of the spine.

Vaginal Examination. — Early in labour the recognition of the face is not easy and in many cases the presenting part may be too high up to be reached satisfactorily. As the face does not fill up the lower uterine segment properly, the membranes may bulge in a finger-like process and so rupture early. When the os is sufficiently dilated to allow of accurate investigation, the face is recognized by the bony ridges round the eyes, the nose, mouth, chin, etc. It is always a doubtful

expedient to try and pass the finger into the openings felt, as injury may be done, but if the finger is very gently inserted into the mouth, the hard ridges of the gums are almost unmistakable and sucking movements may be felt. The face is said to be easily mistaken for the breech on vaginal examination, and this is possible if the cheeks are greatly swollen by the caput succedaneum, so as to resemble the buttocks. The cheek bones felt through the swollen cheeks resemble the tuberosities of the ischia felt through the buttock, and the nose and mouth felt between may suggest the genital organs and anus in the cleft between the buttocks. This difficulty in diagnosis will only arise when the presenting part has not been made out as the head by abdominal examination. The distinction is to be made — (1) By carefully identifying the characteristic points already mentioned, the bony margins of the orbits, the hard ridges of the gums, and so on ; (2) by the absence of meconium ; and (3) by passing the finger to the sides of the presenting part and feeling for the ear (this is the most satisfactory in all cases of doubt). If the ear is certainly distinguished, the head must present.

Management of Face Presentation.

The important matter is to make the diagnosis early ;—if the presentation cannot be identified with certainty, medical help must be sent for, in accordance with the rule of the C.M.B., " Where no presentation can be made out." As soon as the presentation is recognized as a face, medical help must be sent for. The midwife must send in any " Presentation other than the uncomplicated head or breech." Does the extension of the head make a face presentation a " complicated " head ? It is generally accepted that a face presentation is one which the midwife ought not to attend alone, and that for the very good reason that it is so often caused by contracted pelvis or other primary condition for which help is required. Hence the treatment as soon as the diagnosis is made resolves itself into the midwife doing what she can to avoid rupture of the membranes while awaiting the doctor's arrival. No further vaginal examinations should be made, the patient must be restrained from bearing down, and is best kept in bed. When the patient is not seen till the face is at the outlet and with the chin forwards, the delivery will probably take place soon and before assistance can be obtained. In such cases the midwife must deliver by keeping back the forehead with the thumb and hooking down the chin from under the pubes with the fingers (in a similar manner to the delivery of the flexed head, p. 145) till the chin appears from under the pubes, and then try and deliver the rest of the face between the pains. Face presentation in multiparæ due to uterine obliquity usually gives rise to no difficulty in delivery.

Care must be taken not to press too firmly on the face, as the fingers easily damage the delicate surface of the skin.

In mento-posterior cases with the face low in the pelvis and when medical assistance will be long in arriving, the forehead may be pressed up or the chin hooked down during a pain to promote extension, and if this does not produce forward rotation of the chin, an attempt to rotate the face may be made by seizing it between the fingers and thumb over the cheek bones and turning the chin forwards round that side of the pelvis towards which it is directed, and at the same time pushing the anterior shoulder by the other hand on the abdomen over in the same direction. (Compare instructions, p. 154 and Fig. 73.)

The face is greatly swollen in face presentations, especially the lips, cheeks, and eyes, and sometimes there is some obstruction to the child's breathing in consequence, so that it may require careful watching for a time. If the appearance of the child is very unsightly, it ought not to be shown to the mother for two or three days, by which time the features will have become almost normal.

Brow Presentations.

In this presentation the head is midway between flexion and extension, the forehead being the lowest part. The causes are much the same as those of face presentation, but contracted pelvis may be mentioned as playing an even more prominent part in its causation than in face cases. Brow presentations may be

considered as a stage on the way from flexion to complete extension, and the head being in a state of unstable equilibrium may appear as a brow early in labour and later on appear as a face.

With a head and pelvis of average size, delivery is impossible with this presentation, as the maximum vertico-mental diameter ($5\frac{1}{2}$ inches) engages at the brim. Hence it is not necessary to distinguish the positions of the brow, as some other presentation must take its place for delivery to occur. Sometimes the forehead is taken as the denominator, and a first or left fronto-anterior position, a second or right fronto-anterior, and so on in the direction of the hands of a clock, are described. The head frequently enters in the transverse diameter of the brim, and, in such cases, only two positions are possible—one with the face to the right and the occiput to the left, and the other with the occiput to the right and the face to the left. There is no proper mechanism, but birth may occur by—(1) The head becoming more extended until the face presents and labour proceeding as described for such cases ; (2) the head becoming flexed and labour taking place as in a vertex ; (3) with the small and soft head of a premature fœtus and a roomy pelvis, delivery

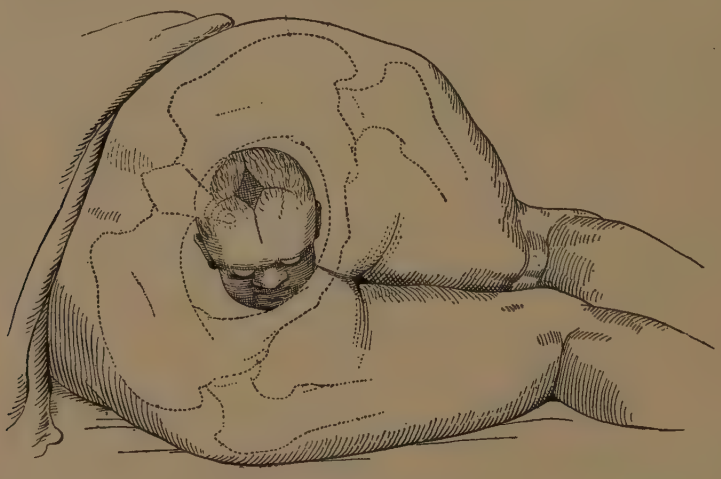

FIG. 78.—BROW PRESENTATION ; VAGINAL EXAMINATION IN THE LEFT LATERAL POSITION.

The forehead is presenting, midway between the root of the nose and the anterior fontanelle. The eyes with the orbital ridges will be easily felt in one direction and the scalp with the anterior fontanelle in the other. The maximum vertico-mental diameter here occupies the right oblique.

as a brow is possible by the following mechanism. The head is forced down into the pelvis, and the forehead being the advanced part is, in accordance with the usual rule, rotated forwards under the pubic arch, the face becomes fixed behind the symphysis, and the head is born by a process of flexion ; the vertex and then the occiput pass over the perineum, and the face slips down from behind the symphysis. If the head is of normal size and the presentation is not changed, great moulding of the head will occur and the brow will be forced into the pelvis and there become impacted, giving rise to obstructed labour.

This presentation ought to be studied by the pupil with the fœtal skull, dummy fœtus, and pelvis, and the following points specially noted. That when the brow presents the head is midway between flexion and extension ; that the finger would find the forehead presenting, and if passed in one direction along the frontal suture would reach the anterior fontanelle and in the other the root of the nose. That the maximum vertico-mental diameter engages in the brim. That the head being compressed between the vertex and chin, that diameter will be diminished by moulding whilst the suboccipito-frontal and occipito-frontal diameters are increased. Place the head in the transverse diameter of the brim with the brow presenting and note the two positions described, and follow the mechanism described for a small

head and a roomy pelvis ; also note the obstruction that would occur with a full-sized head wedged into the pelvis if the presentation remained.

Diagnosis of Brow Presentations.

Abdominal Examination.—The child will be in the long axis of the uterus, with the head below but high above the brim, and not engaged. Frequently, owing to the high position of the head, both occiput and chin can be made out and may be noticed to be on the same level ; if this can be done it will be possible to decide the position, for the head will be lying transversely with the chin to one side and the occiput to the other. The umbilical and fundal examinations and the fœtal heart sounds do not help to differentiate this presentation from other cephalic lies.

Vaginal Examination.—At first the presenting part is high up, and the membranes generally present in an elongated shape, and rupture early. When the presenting part can be reached, the finger will touch the forehead about midway between the root of the nose and the anterior fontanelle, both of which can be felt by following the frontal suture. If the caput succedaneum, which forms over the frontal bones, should obscure the suture, the finger passed round the presenting part will feel the face with the eyes and hard orbital ridges on one side and the anterior fontanelle on the other. Hence the diagnosis by vaginal examination is not difficult when once the presenting part can be reached, and the only mistake likely to be made is to think that it is a face and not a brow.

Treatment.—Send for medical assistance as soon as a diagnosis is made or because the presenting part is out of reach. Should the midwife blunder and not appreciate the state of affairs at first, the want of progress in spite of good uterine action, and later, the development of the signs of obstructed labour (p. 194), will attract the notice of the most obtuse attendant, but the delay will be serious to both mother and child and further neglect may result in rupture of the uterus.

CHAPTER XV.

BREECH PRESENTATIONS.

By breech presentation is meant any presentation of the lower pole of the child, and in it is, therefore, included—

1. **Complete Breech,** when the child presents by the breech and its attitude in the uterus is the usual one of general flexion. The thighs are flexed at the hips and the legs at the knee, so that the feet are near the buttocks ; the head, arms, and spine are flexed as usual, and the child may be said to be sitting in the pelvic brim with the legs drawn up. It is just the normal longitudinal lie, but with the head up instead of the head down.

2. **Incomplete Breech,** when there is extension of some part of the lower extremity. The following are the varieties in incomplete breech :

(*a*) *Extended legs.*—Here the legs are extended at the knee, so that the feet instead of being near the breech are at the child's neck (Fig. 85).

(*b*) *Footling Presentations.*—Here one thigh is extended as well as the leg, so that the foot hangs down. Naturally, this condition will not appear till the os is sufficiently dilated to allow the foot to prolapse. Both feet may come down, forming a double footling.

(*c*) *Knee Presentations.*—Here one thigh is extended, but the leg remains flexed on the thigh. This is a rare condition and will not be present early in the first stage.

Causes.—All the conditions mentioned for abnormal presentations hold good in breech cases. It is especially frequent in premature births, also in twin delivery. The malformation most likely to produce breech presentation is hydrocephalus (water on the brain).

The breech presents in the four quadrants of the pelvis, with its widest diameter —that between the hips—the bitrochanteric (=4 inches), in one oblique diameter, and the cleft between the buttocks in the other oblique. The relation of the child's back to the back or front of the mother is the same in each position of the breech as the corresponding position of the vertex ; the sacrum is taken as the denominator, and the four positions (enumerated in the same order as in vertex presentations) are—

First Position.—Hips in left oblique *Second position.*—Hips in right oblique	Sacrum forwards and	to left—L.S.A. to right—R.S.A.
Third Position.—Hips in left oblique *Fourth Position.*—Hips in right oblique	Sacrum backwards and	to right—R.S.P. to left—L.S.P.

As in vertex presentations, the positions with the child's back forwards are more common, because the child best accommodates itself to the shape of the uterus in that way ; and of the two, the first, with the back to the left, is more common than the second.

Mechanism of Breech Presentations.

To study these mechanisms the dolly is essential, though the skull is of use when the birth of the head is considered.

First notice the positions of the breech and the diameters of the brim occupied by its diameters. Place the dolly in the brim, breech first, and with the limbs flexed. In the first position the sacrum will be opposite the left foramen ovale, with the cleft between the buttocks in the right oblique diameter and the width of the hips in the left oblique. Now turn the breech round the pelvis in the direc-

tion of the hands of a watch until the sacrum points to the right foramen ovale, and note that the cleft between the buttocks and the width of the hips are in the opposite oblique diameters, the position now being the second ; similarly, continue the movement of the breech in the same direction, till the sacrum is opposite the right sacro-iliac joint (third position), and opposite the left sacro-iliac joint (fourth position), and note which of its diameters are in the oblique diameters of the brim.

Now study the mechanism in the first position. The movements which the child makes during its descent through the pelvis may be described under the following heads :

1. Internal rotation of the hips.
2. Lateral flexion of the body.
3. Birth of the shoulders.
4. External rotation.
5. Birth of the head.

1. **Internal Rotation.**—The sacrum is opposite the left foramen ovale and the width of the hips in the left oblique diameter, *i.e.* one hip is anterior and to the right and the other hip is posterior and to the left. The first movement which takes place is one corresponding to that of flexion in the vertex presentations, namely, that the anterior buttock, *i.e.* the one to the right of the symphysis, the child's left buttock, descends in front of the other as there is less resistance to its descent in the anterior half of the pelvis. By this buttock descending in advance, instead of the two hips keeping the same level, a smaller diameter than the bitrochanteric occupies the pelvis, and in addition this movement brings about the internal rotation according to the usual rule, because the anterior buttock being in advance first meets the resilient pelvic floor and is therefore rotated to the free space under the pubic arch. This movement, which takes place when the breech is well down in the pelvic cavity, and therefore influenced by the pressure of the resilient posterior segment of the pelvic floor, results in the anterior buttock rotating from nearly opposite the right foramen ovale to under the symphysis, and the posterior buttock from the left sacro-iliac joint to the hollow of the sacrum. The result is to bring the wide bitrochanteric diameter into the wide diameter, the antero-posterior, of the outlet.

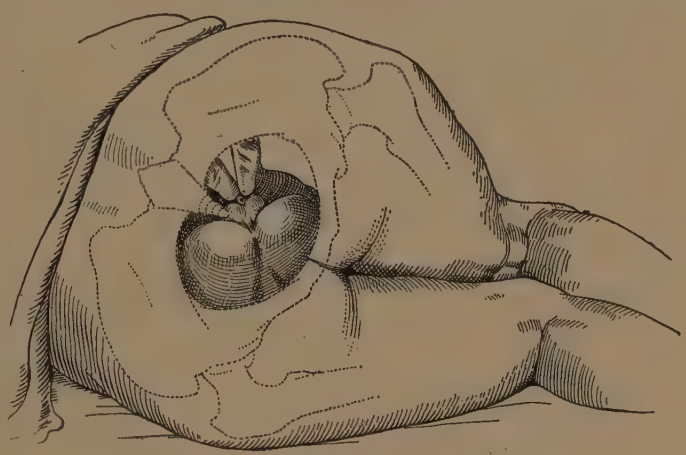

FIG. 79.—THE FIRST POSITION OF THE BREECH (L.S.A.) AS FOUND ON VAGINAL EXAMINATION.

The sacrum is forwards and to the left and the cleft between the buttocks in the right oblique diameter. The bitrochanteric diameter is in the left oblique diameter. The left hip is anterior and to the right, and the right hip is posterior and to the left. The left hip descends in advance and rotates under the pubic arch, and the sacrum looks directly to the mother's left.

2. **Lateral Flexion of the Body.** — This flexion of the trunk of the child is necessary to accommodate the body to the curved canal of the pelvis along which it is travelling. The uterine force is pushing the child downwards and the elastic posterior segment of the pelvic floor and perineum are pressing the buttocks forwards towards the pubes, so that the trunk of the child is, so to speak, bent round the symphysis. The anterior buttock appears first, and then the posterior slips over the perineum, and the rest of the body follows, bending round the symphysis.

3. **Birth of the Shoulders.**—When the breech is born, the shoulders enter

the pelvic brim with their breadth—the bisacromial diameter ($4\frac{1}{2}$ inches)—in the same oblique diameter, the left, as the hips had occupied, the body being slightly twisted as well as laterally flexed to allow of this. This twisting will disappear, as the body is being born by a process like that of restitution in case of the head, but the movement is so slight as to be unnoticeable. The shoulders also come down with the anterior shoulder in advance, thus allowing a smaller diameter than the full bisacromial to engage the pelvis, and further bringing about the internal rotation of the shoulders; the anterior shoulder is rotated under the pubic arch and the posterior sweeps over the perineum, the wide bisacromial diameter thus occupying the wide antero-posterior diameter of the outlet. The shoulders are born with the arms folded upon the chest.

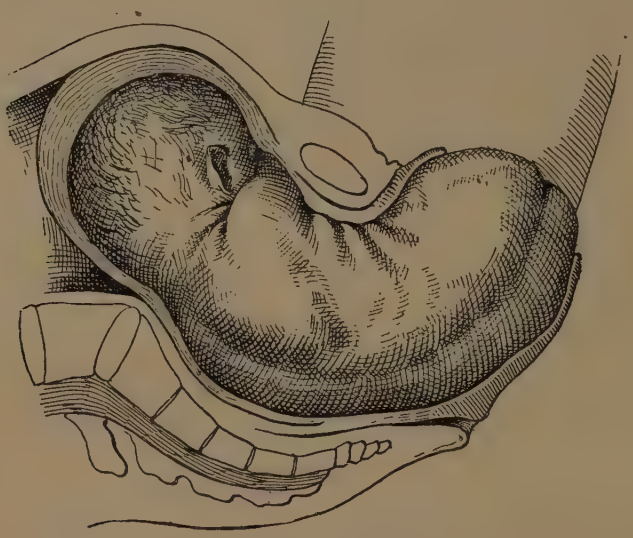

FIG. 80.—LATERAL FLEXION OF THE BODY (THIRD POSITION OF THE BREECH).

The anterior (right) hip has rotated under the pubic arch and appeared at the vulva. The posterior hip (left) is escaping over the perineum. The sacrum is looking directly to the mother's right side. The trunk is bent round the symphysis. The shoulders are entering the pelvis in the same oblique diameter as that previously occupied by the hips, so that the body is also slightly twisted. The anterior shoulder (the right) is in advance of the posterior and will rotate forwards under the symphysis.

4. **External Rotation.**—The external rotation of the body corresponds to the internal rotation of the head. The head enters the brim flexed with the sub-occipito-frontal diameter in the opposite oblique to the buttocks and shoulders; the occiput, which looks in the same direction of the sacrum, being opposite the left foramen ovale. The occiput rotates to behind the symphysis, so that the nape of the neck is underneath the pubic arch, while the face occupies the sacral hollow. The body, following this movement of the head, rotates externally back again towards the right, so that the shoulders lie at right angles to the length of the vulva, *i.e.* in the transverse, and the child's back looks directly upwards.

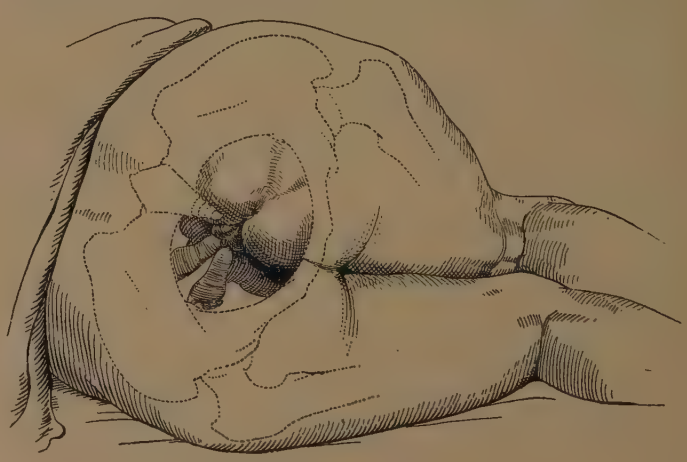

FIG. 81.—THE SECOND POSITION OF THE BREECH (R.S.A.) AS FOUND ON VAGINAL EXAMINATION.

The sacrum forwards and to the right; the cleft between the buttocks in the left oblique diameter, the bitrochanteric diameter in the right oblique. The right hip is anterior and to the left, the left hip posterior and to the right.

5. **Birth of the Head.**—As just mentioned, the head has rotated so that the

nape of the neck is under the pubic arch, the occiput behind the symphysis, and the face and forehead in the hollow of the sacrum. The head is born by flexion, the chin, face, forehead, vertex, and lastly the occiput slipping over the perineum. A little consideration will show that, with the nape of the neck tightly under the symphysis, the largest diameter to distend the outlet will be the suboccipito-frontal at the time of the passage of the forehead.

The mechanism of the second position, R.S.A., is the same as in the first, except that right is substituted for left.

Mechanism in Sacro-posterior Positions (Third and Fourth).

There is not as much difference between the mechanism of these positions and the sacro-anterior as was seen between posterior and anterior positions of the vertex and face, and the reason is plain. Whether the sacrum looks forward or backward there will always be one hip to the front, and therefore a short internal rotation of that hip will always bring the bitrochanteric diameter into the antero-posterior of the outlet, and the like holds good for the shoulders. Hence the internal rotation of the hips, the lateral flexion of the body, and the birth of the shoulders will follow the mechanism as described. It is only when we come to external rotation and the birth of the head that any difference of moment will arise. Take, for instance, the third position—R.S.P. The bitrochanteric diameter is in the left oblique, the cleft between the buttocks in the right oblique, and the anterior hip—the child's right—is opposite the right foramen ovale. That hip descends first, rotates through one-eighth of a circle to under the pubic arch, thus bringing the bitrochanteric diameter into the antero-posterior at the outlet. The anterior hip (the right) emerges under the pubic arch, the posterior over the perineum (Fig. 80), and the body follows, being born by the lateral flexion of the trunk round the symphysis. The shoulders come down with the bisacromial diameter in the same oblique as the hips (the left) and with the anterior shoulder (the right) in advance; that shoulder rotates under the pubic arch, the posterior or left shoulder emerges over the perineum, and the body and arms are born. Now comes the difference; instead of the anterior hip turning back again towards the side from which it started, the right in this case, the direction of the external rotation is a continuance of that of the internal rotation, so that the anterior hip, the child's right, rotates over to the left, thus bringing the child's back to look directly upwards as before. This difference means that the internal movement of the head is different from that in the first position, and ought to be easily understood. The occiput has entered the pelvis well flexed and in the transverse diameter, as it has been carried round with the one-eighth of circle rotation of the child's body about the same amount; the occiput, as the most prominent part, is rotated by the resilient pelvic floor round the right side of the pelvis till the nape of the neck is

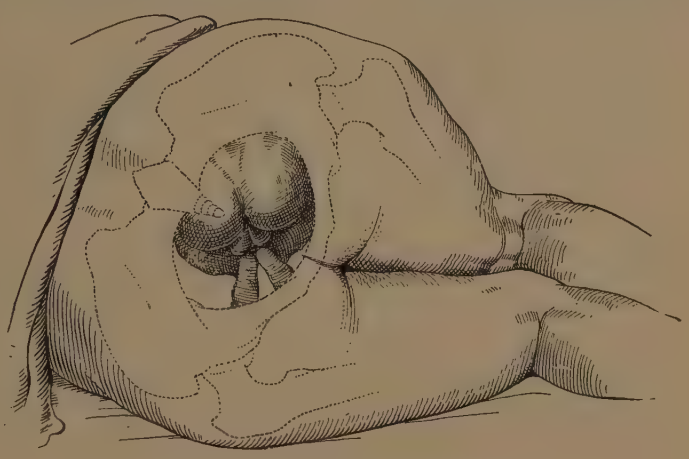

Fig. 82.—The Third Position of the Breech (R.S.P.) as found on Vaginal Examination.

The sacrum is backwards and to the right; the cleft between the buttocks is in the right oblique diameter, and the bitrochanteric diameter in the left oblique. The right hip which is forwards and to the right goes down in advance and rotates under the pubic arch, so that the sacrum looks directly to the mother's right.

under the pubic arch, and that means that the external rotation of the body is continued in the same direction as its internal rotation, *i.e.* towards the left. Thus the occiput makes a long internal rotation of three-eighths of a circle from the right sacro-iliac joint to the symphysis, whilst the body makes one-eighth of a circle internal rotation and two-eighths of a circle external rotation in the same direction. When the nape of the neck is under the pubic arch and the face in the sacral hollow, the birth of the head follows as in the first position mechanism.

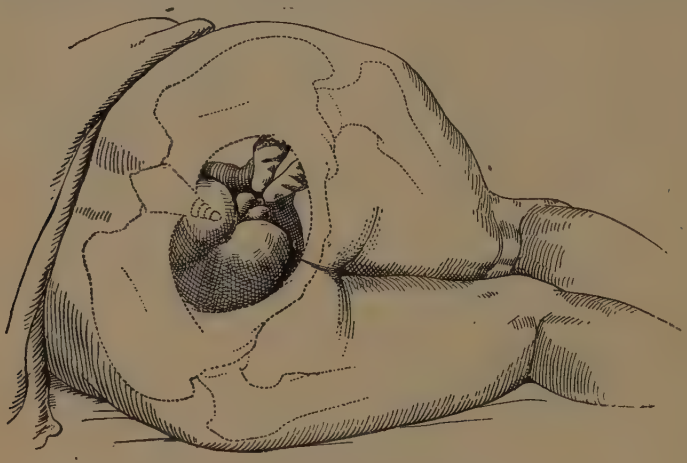

FIG. 83.—THE FOURTH POSITION OF THE BREECH (L.S.P.) AS FOUND ON VAGINAL EXAMINATION.

The sacrum is backwards and to the left; the cleft between the buttocks is in the left oblique diameter, and the bitrochanteric diameter in the right oblique. The left hip is anterior and to the left, the right hip is posterior and to the right. The left hip descends in advance and rotates under the pubic arch, and the sacrum looks directly to the mother's left.

IRREGULARITIES OF MECHANISM.

The usual mechanism may be disturbed for various reasons. For instance, if the presentation becomes a footling—or a foot is brought down for some reason—that side will be lowest and will be rotated forwards by the pelvic floor; so if it is the posterior leg, the hip of that side will come forward instead of the anterior. If the head is extended, the occiput may not be rotated forwards, in which case the face will slip down behind the symphysis, the nape of the neck being grasped by the perineum. This is unfavourable, as when the occiput sweeps over the perineum the occipito-frontal diameter ($4\frac{1}{2}$ inches) distends the outlet. The face slips down from behind the symphysis as far as the forehead, and the occiput escapes over the perineum. Still greater difficulty may arise by the chin catching over the pubes in the very rare cases where the head is markedly extended and the face forwards, thus bringing the maximum mento-vertical diameter ($5\frac{1}{2}$ inches) across the pelvic cavity.

SPECIAL CONSIDERATIONS IN REGARD TO BREECH MECHANISMS.

The mechanism in breech presentations is never so well marked as in vertex cases, because the softer buttocks and body do not require to adapt themselves so exactly to the pelvis as does the hard head. This is especially noticed in the frequent cases of breech delivery with small premature babies and a large roomy pelvis. There may be little or no internal rotation of the breech or shoulders, and in such cases the occiput may rotate backwards. In the labour room it will be found more difficult to follow the details of the mechanism in breech cases than in vertex cases; the best marked part is generally the birth of the head. It is very important that the pupil should understand these mechanisms thoroughly, for the management here, as in all labours, consists in following the natural course of the delivery, and it has a very special importance in that any error or delay will result in the death of the child. The pupil must go over the ground several times with the dolly and pelvis and work out all the details in each position, so that she may have no difficulty in following the practical management of breech cases. A useful point to remember in learning the mechanism is, that though the sacrum is the denominator it is not the part which rotates forwards, but the anterior buttock, and that, therefore, must be watched in going through the mechanism.

Diagnosis of Breech Presentation.

Abdominal Examination.—The child will be lying in the long axis of the uterus. The first thing which will probably attract the attention of the midwife is that she will miss the hard round mass of the head at the pelvic brim. The breech does not, like the head, descend into the pelvis before the onset of labour, and if the patient is seen then or quite early in the labour the following characteristics may be noted. The lower uterine segment will appear broader than usual, owing to the bulkier mass of the breech ; the mass will not feel as hard as the head, and may be noticed to be soft at one place and hard at another. It will be less definite and more irregular in outline, and though high up will not be so movable, especially when tested by the one-handed grip (Fig. 67, p. 129), and cannot be balloted from one hand to the other like the head above the brim. Small fœtal parts at one side of this soft mass and well-marked fœtal movements at the pelvic brim are all in favour of breech.

If labour has advanced further and the breech has sunk down into the pelvis, then it can no longer be felt, because the trunk of the child occupies the brim and prevents the hands being sunk down into the pelvic cavity as they can be over the neck in a head presentation. Hence, though it is difficult to recognize the breech as such, it is not difficult to recognize that the hard round head is absent, and if the child is in the long axis of the uterus this can only be (1) if the head has sunk too low to be felt from above, or (2) if the head is not below at all. In the first case the labour will be so far advanced that the head will probably be visible during a pain, or at any rate so low as to be unmistakable on vaginal examination.

During palpation of the mid-abdominal area the back and limbs are looked for. If the back is to the front (first and second positions), it will be found on one or other side (left or right), and the limbs on the opposite side. If the back is defined, it must be followed downwards and upwards—downwards it will be lost in the mass of the breech, upwards will take it to the fundus, and there careful examination must be made to distinguish the head and thus prove the presentation to be breech. Sometimes the anterior shoulder can be felt as a projection from the back just above the umbilicus. The head is not so easily identified in the fundus as when it is at the pelvic brim, especially in the first and second positions. The first thing, if the back is to the front, is to note that the back does not pass imperceptibly into the breech, so that the breech in the fundus seems to be but the upper rounded extremity of the back as is found in head presentations, but that there seems to be some gap between the hard mass in the fundus and the back, and that this mass is harder, rounder, and more movable than the breech. To confirm the presence of the head in the fundus, the fingers should be sharply dipped down on to the hard body, when it will be felt to ballot or bob about with the tap from the fingers, as it can be moved independently of the trunk while the breech can not. Sometimes it can be tossed from the fingers on one side of the fundus to those on the other. If the back is posterior and the small fœtal parts felt in front of the uterus, the head is more distinctly felt ; the absence of small fœtal parts at the opposite side of the fundus to the hard mass and the absence of kicking movements is also in favour of it being the head. Auscultation is also a help, because the fœtal heart sounds are heard higher up the abdomen in breech than in head presentations. Generally they are best heard about the level of the umbilicus ; if above the umbilicus, the case is very probably a breech. In the incomplete breech the smaller size of the presenting part allows it to descend earlier and deeper into the pelvic cavity, so that the heart sounds are heard lower in the abdomen than in the complete breech.

To make a correct diagnosis all these points must be carefully gone into, as it is only by adding them together that sufficient evidence can be obtained. The most important may be summarized as follows. The head will not be felt at the pelvic brim, and in the fundus will be found a body, harder, rounder, and more movable than the breech, which ballots more plainly and in dorso-anterior cases does not appear to be the upper rounded extremity of the back. The diagnosis will be confirmed by finding the area of maximum intensity of the heart sounds to be higher than in vertex cases, possibly at the level of, or above, the navel.

The diagnosis of the position of the breech, just as in vertex cases, depends on finding the back to the left (first position) or right (second position), the fœtal heart sounds being also best heard on the same side as the back. The small parts are not easily felt, but are most likely to be felt on the opposite side to the back and just above the pelvic brim. In sacro-posterior cases the small parts are felt over the front of the uterus, and the back will not be recognized, or only with difficulty, far out in the flank, the heart sounds being also heard farther out than usual.

Vaginal Examination.—Diagnosis by the vagina is not easy early in labour, because the breech is later than the head in entering the pelvis, and remains longer high up and difficult to reach. But this in itself is an important help, for by the abdominal examination the hard round head, if high up, is almost unmistakable, and if the head has not been felt above the pubes, and on vaginal examination the pelvic cavity is found empty and the presenting part high up, this observation in itself is confirmatory of a breech presentation. Possibly, too, the membranes may project in an elongated shape, because the breech has not the ball-valve effect of the head in the lower uterine segment ; but no weight must be given to the absence of this sign, as it is often missed because the bag when it does form in this way is likely to rupture early. After rupture of the membranes, and when the breech has begun to descend, the nature of the presenting part becomes obvious. The soft buttocks, with the genital organs and the anus in the cleft between them, the feet, and the folds of the groin are fairly characteristic. Meconium also may be passed. It is said that the breech may be mistaken for the face on vaginal examination, and points of difference have already been mentioned (p. 161), but the writer has not seen this mistake made, and, in his opinion, the chances of such an error have been greatly exaggerated. However, as it is a tradition in text-books of midwifery to lay stress on this point, and as questions on it have been set in the examination, it will be as well to state that in a doubtful breech case the finger should be passed along the cleft backwards and forwards and then round the sides of what are thought to be the buttocks. The tip of the coccyx and sacrum will be recognized, the tuberosities of the ischia deep in the buttock, and nothing like the ear will be found. If the finger is passed into the anus it will be gripped by the sphincter ; but this should not be mistaken for a sucking action in the mouth—no hard gums will be felt, and the finger will probably be stained with meconium. These, and the absence of the characteristic signs of the face, will surely prevent mistakes. A much more likely source of error is the distinction between the breech and the shoulder when the presenting part is high up. A caput succedaneum on the point of the shoulder, through which the point of the acromion process can be felt, simulates the buttock, through which the ischial tuberosity can be felt, and the folds of the groin and of the armpit are very similar. The differentiation of these two presentations is best considered with transverse lies (p. 182), and is a more serious matter, owing to the greater risk to mother and child if the shoulder is mistaken for the buttock.

Besides confirming the diagnosis of the presentation, the vaginal examination must also decide the position. The cleft between the buttocks will be found in one or other oblique diameter and must be followed forwards and backwards—like the sagittal suture in a vertex case—till the sacrum is reached. The anus is generally easily recognized in the depression between the fleshy masses of the buttock ; the tip of the coccyx will be felt near the anus, and by carrying the finger in the same direction round the breech the hard bony mass of the sacrum will be located. The feet are generally found on the opposite side of the breech to the sacrum (see Figs. 79, 81, 82, and 83).

Prognosis in Breech Presentation.

A large percentage of breech deliveries occur with small premature children, and the size of the child thus compensates for the other disadvantages of this presentation. With an ordinary-sized child the labour is generally longer ; the breech is later in entering the brim than the head, does not fit the lower uterine segment so well, so that the membranes are liable to rupture earlier, and after rupture the softer breech is neither so good a dilator nor so good a stimulus to uterine action

as the harder and rounder head. Hence the first stage is likely to be prolonged. Apart from complications, a breech presentation adds nothing to the mother's risk, indeed the softer breech may result in an easier and less painful labour than the harder vertex ; but if there is extension of the limbs or head, more internal manipulation is required, and with it an increased chance of infection. Rapid delivery to save the child also adds to the risk of rupture of the maternal soft parts and postpartum bleeding from inefficient retraction. If the delivery by the breech brings no special danger to the mother, it is far otherwise in regard to the child. About 3 to 4 per cent. in multiparæ and 10 per cent. in primiparæ of the children are stillborn, and many die shortly after birth from injuries received during labour. The incomplete breech, especially footling presentations, is more dangerous to the child than the complete breech, because the cervix is not so fully dilated and there is therefore more risk of the head being delayed. The chief causes of stillbirth are:

1. **Compression of the Cord by the Aftercoming Head.** — Compression during the birth of the aftercoming head is unavoidable, as the cord passing upwards from the navel to the placenta is squeezed between the head and the pelvic brim. For this reason delay in the birth of the head is most serious.

2. **Premature Inspiration** (pp. 284 and 19–20).—This is largely caused by the asphyxia produced by compression of the cord, but is aggravated by the stimulation of the cold air on the trunk as the body is born. In head first deliveries there is usually no stimulus to respiration till the head is outside the vulva. In head last deliveries there is not only the stimulus of the asphyxiated blood on the respiratory centres in the child's brain, due to the interference with the placental respiration from compression of the cord, but also the additional stimulus of the cold air on the body after it is born ; as the head is still within the maternal passages, any effort at respiration results in fluids—liquor amnii, blood, and mucus—being sucked into the lungs and so drowning the child.

3. **Separation of the Placenta.**—The head may be expelled from the upper uterine segment and retraction take place sufficient to separate the placenta, or at any rate to check the maternal circulation to it, and yet the head may not be born for some minutes.

4. **Prolapse of the Cord** (Chap. XIX., p. 204).—Early rupture of the membranes and incomplete filling of the lower uterine segment by the breech, especially in footling cases, makes this a more frequent occurrence than in vertex presentations.

5. **Cerebral Hæmorrhage.**—Bleeding into the brain results from tearing of the fibrous partitions—the *falx*, that runs lengthwise through the cranium and divides the right from the left hemisphere of the brain, and the *tentorium* that forms a roof across the posterior part of the cranium and separates the cerebellum from the cerebral hemispheres. If moulding takes place slowly, these fibrous septa can accommodate themselves to it, but with rapid passage of the head may tear, and as important veins run in them, severe bleeding may result. Bleeding into the brain may be due to other injuries to the skull.

Other injuries to the child are liable to occur in complicated breech deliveries and add to the dangers of stillbirth or death soon after delivery. These, however, are best considered after the management of the complications in which they may arise.

Management of Breech Presentations.

The guiding principle in these as in all deliveries is to leave the birth to nature and not to interfere unless for very good reasons. The temptation to interfere is here much greater than in head first deliveries, for once the breech is born there is something to drag on, and the untrained and unskilled attendant is very apt to seize the opportunity of giving nature a help by hauling on the partially delivered body. It is a most fatal error which nature punishes by bringing many disasters in its train.

To lessen the risk of early rupture of the membranes, make as few vaginal examinations as possible, and never while the bag is tense during a pain. Keep the patient in bed, and see that she makes no bearing-down efforts, also does not strain when the bowels act. When the membranes rupture, make a vaginal examination

to confirm the diagnosis and make sure that there is no prolapse of the cord or a limb. Listen to the fœtal heart at intervals and note its rate ; slowing of the rate, or marked quickening with irregularity are signs of fœtal distress. A rate below 100 is a danger signal, but make sure it is the fœtal heart and not the maternal pulse. In the second stage, labour is best managed with the patient on her back, for the same reasons as in the third stage (p. 147).

As the breech descends into the pelvic cavity, make a careful examination to see that the legs are not extended (p. 174) and leave things to nature as long as the condition of mother and child is good. When the birth of the buttocks is imminent, as shown by the distension of the perineum, have a warm cloth ready to cover the lower limbs and trunk so as to avoid the stimulus to respiration of the cold air on the body, and have everything ready for a hot bath in case the child is born asphyxiated. When the breech presents at the outlet, put the patient on her back across the bed, as this position gives better control of the fundus. As the breech passes over the perineum, do not do more than guide it forwards towards the pubes, and, if necessary, disengage the feet. As the body is being born keep it

Fig. 84.—Delivery of the Aftercoming Head. Patient on her Back.

The head is being pressed downwards by the left hand (as shown by the arrow on the patient's right thigh), while the body is carried up towards the mother's abdomen by the right hand (as shown by the arrow on the patient's left thigh). Another method of carrying the child up is to grasp it by the pelvis (not the abdomen) ; in difficult cases this grasp gives a better purchase.

covered with a warm cloth, and as soon as the navel is outside feel the pulsations of the cord, and if they are strong the midwife will know that there is no need for haste. Instructions are generally given that the cord should be put into that part of the pelvis where it is least exposed to pressure. This sounds very well, but practically it is useless. No doubt the cord would be least exposed to pressure in the space at each side of the promontory opposite the sacro-iliac joints, and would be most exposed in the middle line behind over the sacral promontory or in front between the head and the pubic bone. But this is not easily determined, as the cord has many devious turns and twists inside the body, and if it were determined, the cord is so flexible that it would be no easy conjuring trick to change its position at the level of the pelvic brim by sleight of hand outside the vulva. And there is always the risk that matters may be made worse by the manipulation. A loop may be pulled down for observation, and if it is pulsating well, leave well alone. If the pulsation is slow, feeble, or irregular, and the cord appears to be caught in the middle line in front or behind, an attempt may be made to move it to one side. From now onwards the mother should assist by strong bearing-down efforts, and if the upper

part of the trunk is not quickly born, the midwife must examine to find out whether the arms are folded on the chest or extended above the head. If the elbows are not felt, she will have to act as described below (p. 175). When the shoulders are born, a hand (assistant's if present) should exercise firm pressure on the fundus uteri, and as soon as the body has rotated so that the back looks upwards and the nape of the neck is underneath the pubic arch, the head should be delivered by a strong bearing-down effort. If not, delivery should be effected by swinging the child's body up towards the mother's abdomen with one hand assisted by downward pressure on the fundus (Fig. 84). This procedure is the same as that for expression of the after-birth ; the head has escaped from the upper uterine segment, which is retracted above it, so pressure is made downwards and backwards. See at once that the child breathes ; if it does not, at once proceed as described under Asphyxia of the Newly Born (Chap. XXVII.).

Review of the Management of Normal Breech Cases.

As a few minutes' delay in the birth of the head after the body is born may mean the suffocation of the child, prompt delivery of the aftercoming head is essential. The child will rarely survive if more than five minutes elapse after the body is born beyond the navel. As the head comes last and is the largest part of the child, special care will be required in cases of first labours in which the soft parts are likely to be less yielding. The extra risk of breech delivery in primiparæ was recognized by the C.M.B. in their first rules, and the midwife under them was ordered to send for medical aid and is still so ordered in Scotland. Now she may attend uncomplicated cases in primiparæ and multiparæ alike, and it may be fairly stated that the delivery of the aftercoming head requires as much judgment and skill as anything the midwife has to do. Hasty interference by pulling on the child's legs will produce extension of the arms and head and so delay the birth ; fundal pressure is the only proper method of hastening delivery, as it promotes flexion.

These instructions may be summarized as follows :

1. Do all you can to avoid rupture of the membranes. Conduct the delivery with the patient on her back.
2. Keep the child's body covered with a warm cloth as it is being born.
3. Do not interfere till the child's body is born as far as the navel.
4. Observe the pulsation of the cord ; if it is good and regular, there is no need for haste ; if it becomes weak and irregular, or slow, delivery must be completed rapidly.
5. Do not pull on the legs, but if it is necessary to hasten delivery, press on the fundus to avoid extension of the arms and head. Push out ; do not pull out.
6. If the arms are extended, proceed as described on pages 175–6.
7. If there is delay in external rotation, this may be assisted by rotating the body in the direction proper to the position so that the back looks upwards.
8. If bearing-down efforts fail to expel the aftercoming head, press the head down firmly from the abdomen till the nape of the neck is under the pubic arch and the face ready to roll out over the perineum. Then raise the child's body towards the mother's abdomen and express the head from above (Fig. 84).
9. If the head is extended and the above method fails, proceed as described on page 176.
10. If the child is asphyxiated, at once adopt means for its restoration (p. 286).

Difficulties and Delay in Breech Presentations.

The same difficulties and complications may be met with in breech as in vertex cases ; indeed some of them occur with greater frequency in breech than in vertex presentations. Among the causes of breech presentation were mentioned such complications as contracted pelvis, placenta prævia, hydrocephalus, and so on ; prolapse of cord has also been mentioned as not infrequently complicating breech deliveries, and delay may occur from uterine inertia in this as in other labours. Impaction of the breech in the pelvis may occur from the breech being too large or

the pelvis too small, but this is no different from impaction of the head in the pelvis for like reasons ; it is a form of obstructed labour. These conditions will be discussed in their own place ; at present, only the difficulties peculiar to the breech will be considered.

The chief difficulties peculiar to the breech are extension of the legs, arms, and head.

1. **Extension of the Legs.**—With small premature children this will offer no difficulty. With a roomy pelvis and an average-sized child, birth will also take place without difficulty. On the other hand, in a primipara or a woman with pelvis on the small side, or with a large child, extended legs may form a very serious obstruction to labour. If the legs are extended along the child's trunk, they act as splints and interfere with the lateral flexion of the body so that it cannot turn round the symphysis to allow the breech to be born. There will be no difficulty in the breech descending into the pelvic cavity, the incomplete breech is smaller than the complete breech and easily enters the brim and may get quite low down in the cavity, far enough for the breech to appear at the outlet with each pain, but it cannot follow the curve of the birth canal and, so to speak, turn the corner, because of the rigidity of the body, due to splinting by the legs extended along it.

Fig. 85.—Breech with Extended Legs.

(Photograph of a specimen (No. 32) in the Museum. General Lying-in Hospital, York Road.)

Note how the breech is smaller than the upper part of the body and will enter the brim easily. Difficulty will arise when the movement illustrated in Fig 80 ought to occur.

The midwife will recognize the condition by the delay in the advance of the breech in spite of good pains, and by finding on vaginal examination that the feet are not alongside the breech, and that on following the thigh up to the bend of the knee, the knee is straight out and not bent as it should be. The sooner this condition is recognized the better, because the lower the breech has sunk into the pelvis, the more difficult does it become to disengage a leg. The breech may have to be pushed up under chloroform if it is found necessary to bring down a leg. Therefore, if there is any delay in the descent of the breech, the midwife should satisfy herself that the legs are not extended. Medical aid should be summoned at once if extension of the legs is discovered. The case then becomes one of complicated breech, and as there is no pressure on the cord to make it urgent to complete delivery for the sake of the child, the midwife ought not to try and bring down a leg. Unless she is in a very out-of-the-way place she can await the doctor's arrival. If the condition is not discovered till the breech is being born, then the child is evidently small or the pelvis roomy enough for it to pass, and there will be little difficulty. Fundal pressure should be made till the body is born as far as the navel ; if it is arrested,

then traction should be made with a finger in the posterior groin, the fundal pressure being kept up at the same time, and as soon as the body is far enough down to allow the knees to be flexed and brought down this should be done. The important points to be borne in mind are—(1) That though many cases of extended legs are born quite easily, serious impaction of the breech may occur and give rise to a very difficult delivery ; (2) that there is no urgency unless the case has been neglected and left too long ; and (3) that it is a complicated breech and therefore calls for medical aid. Some cases require treatment by bringing down a leg, others by traction on the groin, and a doctor must decide which is better under the circumstances. Also extension of the arms is often present.

2. **Extension of the Arms.**—This generally results from traction on the body, but may arise from contracted pelvis or from early rupture of the membranes, so that the cervix is not fully dilated and drawn up and the rim of os catches the elbows. Delay will occur when the body is born as far as the navel, and on passing up the fingers the arms will not be found folded on the chest ; instead of feeling the elbow,

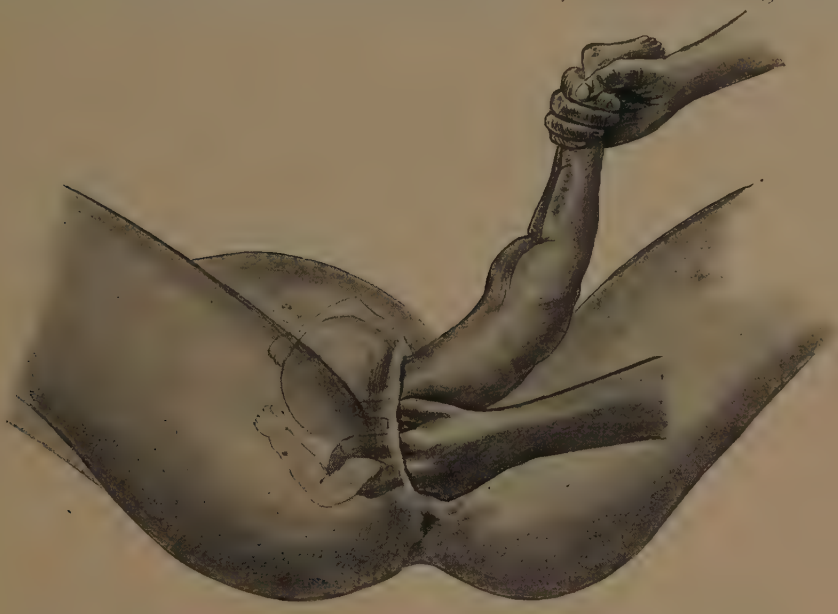

Fig. 86.—Breech with Extended Arms. Bringing down the Posterior Arm.

The child's body is drawn down and swung upwards so as to bring the posterior shoulder as low as possible. Two fingers of the left hand are passed up to the elbow and bring down the arm with a wide sweep across the child's face.

the finger running up the side of the chest will reach the armpit and find it open and the arm up. This condition, if not quickly corrected, will cause the death of the child from suffocation. The arms extended alongside the head prevent its passage through the pelvic brim. Therefore, if the child is to be saved, the arms must be brought down. It is a complication, but it is also an emergency, and if the midwife waited for medical aid and did not act promptly the child would be suffocated. It is quite different from extension of the legs ; the matter is too urgent to brook delay, and the midwife must know exactly how to proceed. If there is any one to assist her, let the assistant apply strong pressure to the fundus. Swing the trunk towards the mother's abdomen, making slight traction on the body, and proceed to bring down the posterior arm first. There is much more room in the hollow of the sacrum than behind the symphysis, and the anterior arm is tightly jammed between the child's body and the symphysis owing to the lateral flexion of the body. Bring down the left arm with the left hand and the right arm with the right hand. The fore and middle fingers are passed along the shoulder-blade, over the axilla, and along the upper arm till they reach the elbow. Sometimes by pressing on the point of the elbow the arm can be pushed down in front of the face till the hand is within easy reach.

If not, the fingers are pressed into the bend of the elbow ; by pressing it outwards the arm will flex, and then with the two fingers the forearm is swept down over the child's face towards the opposite side until the hand is brought down into the vagina. The hand is then brought outside, and with gentle traction and by holding the body well forward, the point of the shoulder may be delivered over the perineum. The escape of the posterior shoulder gives the extra room corresponding to the distance from the point of the shoulder to the neck, and as there is also some descent of the body, the extraction of the anterior arm is not difficult. To do this, swing the child back towards the perineum and with the corresponding hand sweep the anterior arm down over the child's face and bring it outside. If the posterior shoulder is outside the vulva there is generally no difficulty with the anterior arm, but should this not be the case, and should the anterior arm be found tightly wedged between the child's body and the symphysis, it must be disengaged from this position by rotating the child's body so as to bring the shoulders into the oblique diameter or even as far as to make the unborn shoulder posterior. The arm already delivered must be drawn forwards towards the front of the child and the back rotated along the side to which it looks. This brings the second arm away from behind the symphysis and towards the hollow of the sacrum, and it must be brought down exactly like the first. Then rotate the body back again, till the back looks upwards, and proceed to the delivery of the aftercoming head. The bringing down of the arms must be done gently, otherwise the arms may be broken and the child injured. Should the pulsations in the cord have ceased before the arms are brought down, there is no chance of saving the child's life, and therefore the midwife had better send for medical assistance and await the doctor's arrival. In any case in which it has been necessary to do this manipulation a doctor ought to be called in to see the child, if alive, and to make sure that no harm has come to the mother.

3. **Extension of the Head.**—This is usually brought about in the same way as extension of the arms, namely, by pulling on the body, but it may also be caused by incomplete dilatation of the cervix, as the breech and body will pass through a smaller cervix than the larger head, or by contraction of the pelvis or large size of the head. In premature children the head is relatively large, and is therefore very liable to be caught in a cervix which has allowed the body to pass. The extension of the head results in the occipito-frontal diameter ($4\frac{1}{2}$ inches) taking the place of the suboccipito-frontal (4 inches). The midwife must act promptly in this condition, as it is the only chance of obtaining a living child. The head will probably be arrested at the brim, the base of the skull will be through but the vault detained at the level of the biparietal diameter. The midwife will know this because the vertex can be felt above the brim on abdominal examination, the face is not down in the hollow of the sacrum, and the nape of the neck is not hugging the pubic arch. If an attempt was made to deliver by the ordinary method of expression from above and carrying the child's body upwards before the head was low down in the pelvis, it would only result in serious injury to the child's neck. The head must be brought through the brim till the chin is on the perineum before it can be extracted. To do this the best method is to combine expression from above with what is known as " jaw and shoulder traction," not a good name, as no traction is applied to the jaw, and therefore better amended to " jaw flexion and shoulder traction," as the finger in the mouth is used merely to keep the head flexed, not to apply traction. If there is any one present to help, ask the assistant to undertake pressure on the fundus. If there is no one to do this, put a clean towel over the fundus so as not to soil your hand as it will be required later for manipulation at the vulva. Ride the child's body over the left arm and pass the fore and middle fingers into the vagina and into the child's mouth, inserting them well back on the lower jaw ; if you have no assistant, press the head downwards and backwards from the abdomen with the right hand (over the clean towel), but the better plan is to have continuous pressure kept up by an assistant. The pressure from above pushes down the face, and the fingers on the jaw exercise sufficient pressure to maintain the flexion produced and even to increase it slightly. The fore and middle fingers of the right hand over the shoulders of the child, one on each side of the neck, are first used to increase flexion by pressing on the occiput so as to push the face towards the chest, and then to exert

traction, the chin being meantime held firmly towards the chest by the fingers in the mouth. If the head is high up, traction must be made far back towards the perineum, and, as the head comes through the brim and down into the cavity, the traction is directed more forwards. As the head comes to the outlet the child's trunk is raised, by elevating the forearm on which it is riding, and carried up towards the mother's abdomen, the chin being guided over the perineum by the fingers in the mouth. Fundal pressure by an assistant is helpful throughout the whole manœuvre. It is always better to try and push the child out from above than pull it out from below.

This method described for the delivery of the extended aftercoming head is not the only one ; but it is better that the midwife should know one good method and be thoroughly acquainted with it than try and learn alternative methods. Hence this method only will be described, and must be practised on the model till it is

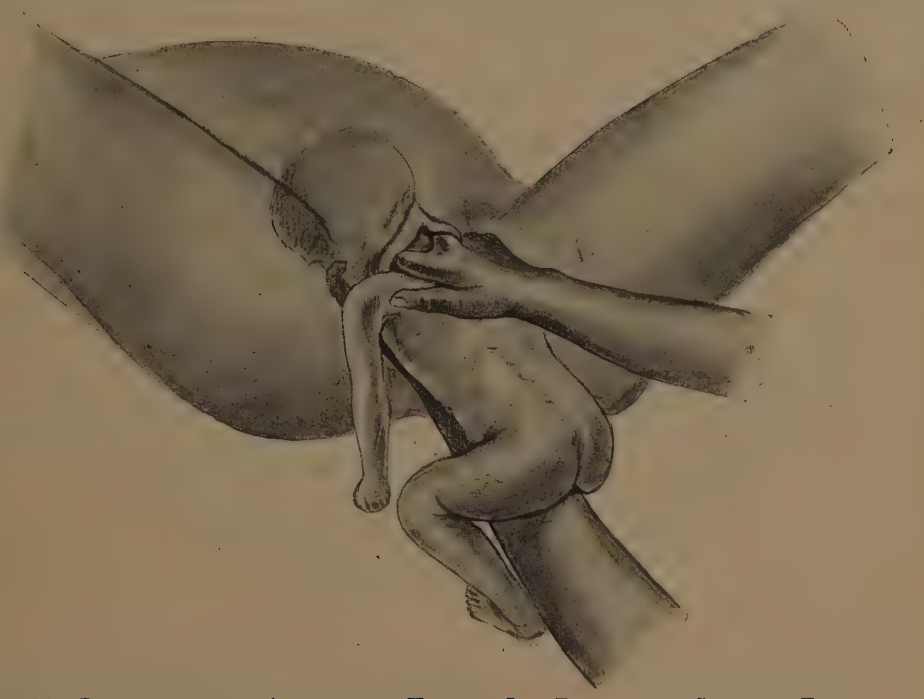

FIG. 87.—DELIVERY OF THE AFTERCOMING HEAD BY JAW FLEXION AND SHOULDER TRACTION.

The child's body rides on the left arm ; flexion is maintained by a finger in the mouth. The fore and middle fingers of the right hand hooked over the shoulder apply traction downwards and backwards. Before commencing traction these fingers may be used to increase flexion by pushing the occiput upwards and so bringing the jaw within easy reach of the internal finger. The child's body is left uncovered to show its position more clearly.

acquired. The midwife should remember that the uterus being nearly empty and much retracted down has less power on the child's head—indeed by the time the head is into the pelvis it has quite escaped from the grasp of the uterus—and hence the value of suprapubic pressure. On the other hand, she must remember the extreme importance of not soiling her hands, so that if the whole procedure has to be done by the midwife herself, the suprapubic pressure must be done in some way to avoid making her right hand unclean, and that therefore it is essential to have a sterilized or freshly laundered towel over the abdomen while doing that part of the manœuvre. She must not forget also that the traction from below is almost entirely exerted by the fingers of the right hand over the child's shoulders. The fingers of the left hand keep the head flexed and help the chin out over the perineum, while the arm, by raising the body as the head comes down, brings the line of traction into the axis of the outlet. Generally, once the head is through the brim the rest of the delivery is comparatively easy.

Other complications of the breech are—(1) Footling and knee presentations; (2) malrotation of the aftercoming head.

(1) If a foot or knee prolapses, the midwife must send for medical aid at once. It may be that it will offer no special difficulties, but the case is no longer one of uncomplicated breech, and there are many possibilities. With a prolapsed limb, there is always the chance of confusing the leg and arm, and an arm means a much more serious condition. The incomplete breech does not dilate the cervix sufficiently and the arms and head may therefore become extended, prolapse of the cord is more likely to occur, and altogether the chances of a stillborn child are greater, and with a living child the risks of injury are considerable. The foot is distinguished from the hand by its not extending straight out in line with the leg, as the hand will do with the arm, by the bony points (malleoli) of the ankle and the projection of the heel being felt as the foot is slipped between the fingers, whilst the toes are of equal length, unlike the fingers, and the big toe cannot be bent into the sole as the thumb can be bent into the palm. It is a good exercise for the pupil to learn to differentiate the foot and hand and knee and elbow by feeling these parts in the newborn child with the eyes shut.

The knee is not unlikely to be confused with the elbow, and it is better for the

FIG. 88.—DELIVERY OF THE AFTERCOMING HEAD BY JAW FLEXION AND SHOULDER TRACTION.

This shows a later stage of the operation than the preceding figure. The head has been brought down to the outlet and delivery is being completed by raising the arm on which the child is riding so that the direction of traction is now upwards towards the mother's abdomen.

midwife, if in doubt, to await the doctor's arrival, as the easiest way to settle the matter is to bring down the foot or hand, and that ought to be left to the doctor.

(2) If the occiput rotates into the hollow of the sacrum, an attempt should be made to rotate it forwards by grasping the face between the fingers and thumb of one hand and with the other turning the body in the same direction. If this fails, carry the body well backwards, bring down the chin from behind the pubes, and when the face is born as far as the root of the nose, carry the body forwards, when the occiput will slip out over the perineum. In the latter method, suprapubic pressure by an assistant will be a great help.

Injuries which may occur during delivery are :

The femur (thigh bone) may be fractured and the soft parts of the groin injured by traction or bringing down a leg.

The humerus (upper arm bone) and clavicle (collar bone) may be fractured in bringing down an arm or during the delivery of the head.

The abdominal organs may be injured by the child being grasped forcibly by the abdomen.

The nerves and muscles at the side of the neck, especially the nerves to the

arm (brachial plexus) and the sterno-mastoid muscle, may be injured while bringing down the arms or extracting the head.

The neck and base of brain may be injured during forcible extraction of the extended head. Hæmorrhage into the brain may result from too rapid delivery (p. 171).

The jaw may be dislocated or broken, and the tongue and mouth injured, during delivery of the extended head.

The recognition of these injuries will be described under the Infant (Chap. XXVII.). If the midwife has any reason to suspect such injury, the child should at once be seen by a doctor.

CHAPTER XVI.

SHOULDER PRESENTATION—TRANSVERSE LIES.

This is not strictly a "transverse presentation," because the child does not present by the "transverse," generally it is by the shoulder, so it should be termed "shoulder presentation." It is popularly called a "cross-birth," because the child lies crosswise in the uterus. But none of these terms is quite correct, as the child does not lie transversely or across the uterus, but obliquely. It occurs about once in 230 full-time births, but is more frequent in premature births. The causes are those mentioned for abnormal presentations; contracted pelvis, uterine obliquity, and prematurity are common causes.

Generally the shoulder presents, and when the os is partially dilated and the membranes ruptured, an arm prolapses. In rare cases, if the lie is almost transverse, the ribs may be felt as the presenting part. The child usually lies with the head or breech in one iliac fossa and the breech or head somewhat above the iliac fossa on the other side, the body running obliquely between them.

Positions.

As it is not possible for a child of average size to be born unless the lie is changed into a longitudinal one, the various positions are not generally distinguished further than into dorso-anterior, those with the back looking forwards, and dorso-posterior, with the back backwards. The acromion process is the point which goes in advance and therefore ought to be the "denominator," except that difficulty would arise from the child's possessing two acromion processes.

If it was worth while to differentiate the positions into the usual four, they would be two dorso-anterior and two dorso-posterior, with the head to the left and right in each. Dorso-anterior transverse lies are commoner than dorso-posterior.

Mechanism.

There is no true mechanism for these cases, though what is described later on as spontaneous evolution is a possible mechanism when the child is small enough and the pelvis large enough for delivery to take place by the natural powers.

Labour may, however, terminate spontaneously, not only by spontaneous evolution, but by spontaneous expulsion when the child is dead, and its body softened, and by the transverse lie being converted into a longitudinal one—spontaneous rectification and spontaneous version. To take the simplest first:

1. **Spontaneous Rectification.**—When the uterine contractions straighten the uterus, they tend to press the child from its oblique lie into a straight one, and so to bring the head from the iliac fossa to the middle line above the pelvic brim. This change will only take place when (*a*) the child is alive or recently dead, (*b*) the membranes are intact and there is sufficient liquor amnii for it to move easily, and (*c*) before any part of the child has sunk into the brim.

2. **Spontaneous Version.**—This is an exactly similar change to the first, except that the breech comes down instead of the head, and is most likely to occur when the breech is in the iliac fossa and lower than the head, but it may occur even when the head was lower to begin with. The conditions required are the same as for spontaneous rectification, though sometimes spontaneous version may take place just after rupture of the membranes when the breech is forced down by the uterus retracting as the waters escape.

3. **Spontaneous evolution,** or spontaneous delivery, may take place with a small premature fœtus, if the uterine contractions are very strong and the pelvis of good size. The mechanism is as follows, say in a dorso-anterior head to right position. The lower shoulder—the child's left—is pressed down into the brim, and, coming first on to the resilient pelvic floor, is rotated forwards under the pubic arch—the arm prolapsing in the meantime. The arm is now outside, the point of the shoulder is under the symphysis, the clavicle and neck are behind the symphysis and form the fixed point round which the body pivots; the head is above the brim on the right, and the rest of the body to the left. The child's body is now pushed down past the shoulder so that the ribs distend the perineum and are born, followed by the buttocks and legs, and then the other arm. The aftercoming head is born as in breech cases.

4. **Spontaneous expulsion** will only occur when the child is small or has been dead long enough to be softened so that it will double up. The shoulder presents and the arm prolapses, then the head is squeezed into the abdomen of the child and the body born doubled up, the head, legs, and other arm coming last. Not infrequently a premature infant may be born by a combination of those last two methods.

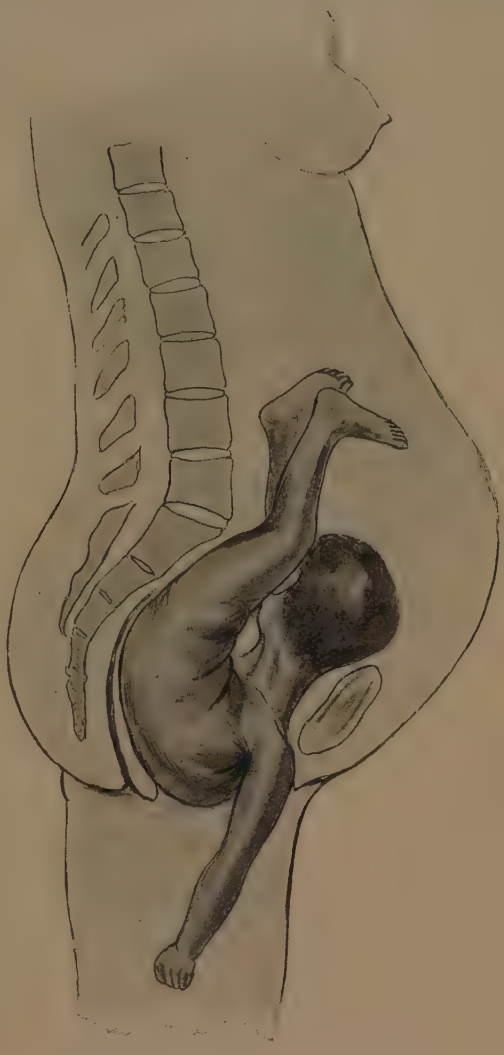

Fig. 89.—Spontaneous Evolution.

The left shoulder has rotated under the symphysis and the arm has prolapsed. The child's body is being pushed past the shoulder and the ribs are distending the perineum. The buttocks and legs will follow, then the right arm, and finally the head.

Diagnosis.

Abdominal Examination.—Transverse lies are easily recognized on abdominal examination, as the whole fœtus is above the brim and accessible to palpation, if seen before rupture of the membranes. The appearance of the uterus may suggest a transverse lie of the child; it is broader, the fundus is lower, and obliquity is unusually well marked. On palpation early in labour, the pelvis will be found to be empty, the head low down in one iliac fossa, and the breech higher up on the opposite side, or *vice versa*. The body of the child will be felt connecting the breech and the head, with the small parts above or below; if the back is to the front, it is easily felt; if the position is dorso-posterior, the small parts are more distinct. Sometimes the fundus is found to be empty, as shown by feeling a depression in the middle line above the umbilicus, between the breech on the one side and the head on the other.

The most frequent difficulty is to distinguish some of the slightly oblique lies, especially when the breech occupies the iliac fossa. As a matter of fact, when active pains start, the case will probably turn out to be a breech, the slight obliquity being corrected by the contractions. If the patient has been in active labour for some

time and the lie is still somewhat oblique, the midwife ought to consider the case as transverse and summon medical aid. Even should it become rectified there will probably be some difficulty in the presenting part engaging. Auscultation is no help in diagnosis, the fœtal heart sounds being best heard below the umbilicus and somewhere about the middle line.

After the waters have escaped, and the uterus has retracted down on the child, abdominal palpation is very difficult. The fœtal parts are squeezed together and cannot readily be distinguished.

Vaginal Examination.—At first no presenting part can be felt and the os will be high up. The bag of membranes will protrude in an elongated glove-finger shape and rupture early. When the membranes are ruptured and the os is partly dilated, the point of the shoulder, the fold of the axilla, the shoulder-blade, collar bone, and ribs may be felt. Sooner or later the arm will come down into the vagina, and the cord may also prolapse. There may be a doubt as to whether the case is a breech or a shoulder presentation. In the shoulder presentations, the os and presenting part are higher and more difficult to reach early in the labour. Later on, when the shoulder is pressed into the brim, the fold of the axilla and the fold of the groin are much alike, but if the ribs or shoulder-blade can be felt the diagnosis is clear. If an arm is prolapsed, it is distinguished from the foot by noticing that it can be extended in a line with the arm, that the fingers are longer than the toes and of unequal length, and that the thumb can be separated from the other fingers and from the palm and bent back into the palm again. There is nothing on the hand like the projection of the heel. If the elbow only is prolapsed, it may be mistaken for the knee. The point of the elbow is much sharper than the knee, and the knee-cap may be movable on the knee. In the case of any prolapsed limb the midwife should send for assistance, but that is no reason why she should not try to make a good diagnosis so long as she does her patient no harm. If medical assistance is not readily available and the diagnosis is important, it may be better to draw down the prolapsed limb so that it can be inspected or felt easily, rather than make an error in diagnosis (p. 178).

Prognosis in Transverse Lies.

Mother.—If the case is seen early the outlook is favourable, but the longer the delay the greater the danger. Neglected shoulder presentations are often fatal from the difficult operations necessary to effect delivery, and unless the lie of the child is changed, rupture of the uterus and death of the mother will occur, as, with a full-sized child, natural delivery is impossible.

Child.—If the case is seen before rupture of membranes, the risk to the child is even then considerably greater than in a breech case, but after rupture of the membranes prolapse of the cord is so common that nearly half the children are still-born. In neglected cases the child is always dead, owing to interference with the placental circulation from excessive uterine retraction.

Midwife's Duty in Transverse Lies.

The duty of the midwife in transverse lies is to obtain medical assistance for her patient at once and meanwhile keep the patient quiet in bed, and if the membranes are unruptured, do nothing which might provoke their rupture. This means that the earlier the case is recognized and the sooner the doctor arrives, the better the outlook for mother and child. Consider what can be done at the various stages at which the doctor may be called in. The treatment of transverse lies is to convert them into longitudinal lies. If the case is seen before the waters have broken and before any part of the child has sunk into the pelvis, version or turning the child may be possible by external manipulation through the abdomen (external version), *i.e.* there will be no internal manipulation and no increased risk of sepsis ; a little later it may be possible to do the same with a little assistance from two fingers internally assisting the hand outside (bipolar version), but once the membranes are ruptured internal version only is possible and the whole hand has to be passed inside

the uterus to turn the child, thus increasing the risk of infection, besides which there is always the chance that the danger to the child will be increased by prolapse of the cord. If the case has been so far neglected that the waters have drained away and the uterus has become retracted down on the child, turning the child will now be dangerous—as it may result in the uterus being ruptured ; the only thing for the doctor to do will be to cut through the neck, push the head up out of the way, and then deliver the decapitated body and afterwards the head, and, as will be easily understood, this is a difficult operation with many risks to the mother. If some operation to break up the wedge formed by the child's shoulder in the pelvis was not done, rupture of the uterus would follow. In fact, the case becomes one of obstructed labour, and the various stages of this condition follow on one another the longer the patient is left. Though these will be described later on (p. 194), it will be as well to mention them here to impress on the pupil the dangers of delay in such cases. The membranes will rupture early, because there is little support to the bag as the presenting part cannot come down and plug the lower uterine segment, and for the same reason the waters drain away quickly unless the arm comes down and plugs the cervix. A large caput will form on the shoulder or, what is more usual, the arm will prolapse into the vagina and become very swollen and dark in colour, so that a dusky swollen hand may protrude at the vulva. The uterus contracts strongly, the cervix is fully taken up, and yet the child cannot be moved further, because the body on the one side and the head on the other, with the shoulder as the point, form a wedge at the brim ; retraction goes on and the upper uterine segment becomes very thick and hard and closely applied to the child, so that this part of the uterus appears in a state of continuous contraction with no relaxation—tonic contraction—whilst the lower segment becomes very much stretched and thinned. Where the thick upper segment joins the thin lower segment a ridge known as the retraction ring or Bandl's ring (p. 194) forms, and indicates that rupture is imminent. The patient, if not relieved, dies of exhaustion or from rupture of the uterus. When the uterus ruptures the child is forced through the rent into the abdominal cavity.

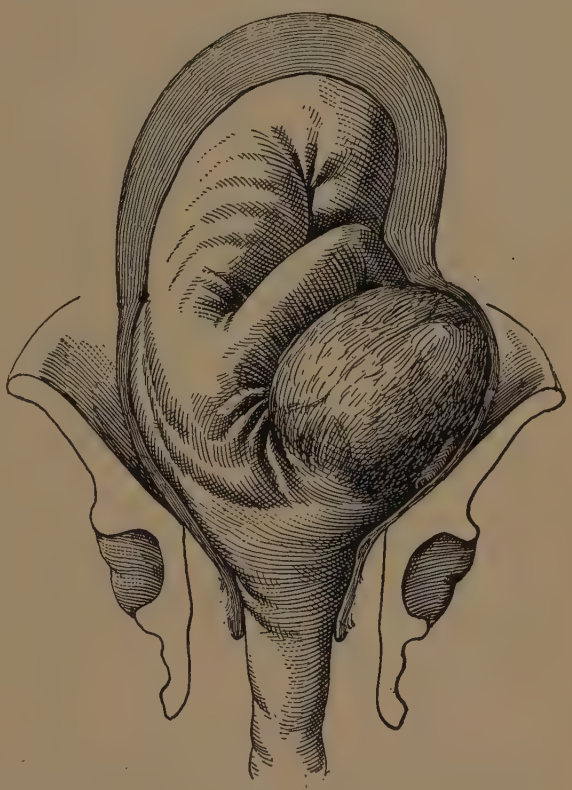

FIG. 90.— IMPACTED SHOULDER CAUSING OBSTRUCTED LABOUR.

The arm has prolapsed into the vagina ; the shoulder is wedged into the pelvic brim. The upper segment of the uterus is greatly thickened and firmly retracted and moulded to the child's body. The lower segment is thinned ; Bandl's ring forms at the junction of the thick upper and thin lower segments.

If the doctor is so far away that it will take many hours for him to come to the midwife's assistance, she may attempt the following procedures. If the membranes are unruptured, by pushing the head through the abdominal wall towards the middle line and the breech upwards, try and work the head over the brim and the breech up into the fundus, and so convert the presentation into a vertex. The head should then be pressed into the brim and maintained there by pads under a tight binder. If the membranes are ruptured and the arm prolapsed, an attempt must

be made to push up the arm and get hold of a leg: gentle traction should be made on the leg whilst the other hand, or an assistant, pushes the head up towards the fundus from the abdomen (see account of version, pp. 310–311). If this is successful it will convert the presentation into a footling, but it must never be attempted if there is any evidence of tonic contraction (p. 195). The best plan is to give full doses of a sedative (15 drops of laudanum) and keep the woman quiet; this checks uterine action, and things will remain more or less stationary and allow time for the doctor's arrival.

Complex Presentations.

Unusual presentations, like the presentation of an arm with the head or even a foot, and the presentation of hands and feet together, may occur, and are especially likely to occur when the presenting part is small, and does not fit the brim of the pelvis properly, or when the pelvis is contracted so that engagement is difficult, or when uterine obliquity is marked.

In all such abnormal presentations medical assistance should be obtained at once.

In the event of the doctor being far off, so that a long time will elapse before he comes, the following suggestions may be helpful. If the hand comes down with the head, try and push it above the head, and then press the head into the brim. Afterwards put on a tight binder and make the patient lie on the side opposite to that on which the hand came down. If the foot should come down with the head, make traction on the foot with the fingers of one hand and with the fingers of the other press the head up, first from below and then, as the head rises, from the abdomen. In this way the presentation will be converted into a footling. A hand and a foot together must be treated as a transverse lie.

Difficult Diagnosis of Presentation.

Though not included under this chapter-heading, it may be allowable to mention here some conditions, for the most part very rare, in which the recognition of the presenting part may be difficult. If the presenting part is high up and not engaged it may be impossible to identify it by vaginal examination, so that doubt must arise unless its nature is clear from the abdominal examination alone. With pendulous belly and exaggerated anteversion of the uterus the descent of the presenting part is delayed. As a result, however, of the laxity of the walls the abdominal examination is easy. In fat women and with œdema of the lower part of the abdominal wall it may be difficult. Hydramnios (p. 87) also gives rise to late engagement of the presenting part, and as the fœtus is usually small the presenting part may not be identified by abdominal or vaginal examination. With a hydrocephalic head or a dead or macerated fœtus the unusual softness of the head may cause hesitation in arriving at a diagnosis. In hydrocephalus (p. 194) the head has an elastic, water-bag-like feel, and the bones of the vault being expanded, movement of them on pressure can be detected. The fœtal movements have not ceased and the fœtal heart sounds can generally be heard. With maceration, on the other hand, the elastic feel of the head is absent, but the movement of the bones may be marked and accompanied by a grating sensation which may be noticeable on abdominal palpation as well as on vaginal examination. If the mother had noticed cessation of fœtal movements for some days and no fœtal heart sounds could be detected, the diagnosis would be confirmed. Malformations and monstrosities may occasion great difficulty, for instance a meningocele or spina bifida (p. 292) may form a soft bulging mass which may obscure the real presenting part or make its identification uncertain. The midwife must keep in mind the possibility of meeting with these rare cases giving rise to difficulty in recognizing the presenting part, and follow the rule of the C.M.B. governing them (E 21 (3)). A correct diagnosis is often only possible by passing the whole hand into the vagina and exploring the brim of the pelvis and all round the presenting part until some part can be definitely identified which will establish its nature. This is usually only possible when the woman is anæsthetized, and in this country, at any rate, it will rarely be necessary for the midwife to attempt to arrive at an exact diagnosis; that can be left to the doctor, who must be summoned when there is a malpresentation, when there is a presentation other than the uncomplicated head or breech, and when no presentation can be made out.

CHAPTER XVII.

MULTIPLE PREGNANCY—TWIN PREGNANCY.

Twin births occur about once in eighty cases. Heredity has a considerable influence in their occurrence; they are commoner among those in whose family twins have been born. Triplets are very rare, about once in 10,000 births.

Twins may be binovular, *i.e.* arise from separate fertilized ova, or uniovular, *i.e.* from a single ovum with two germ areas. Triplets may arise from three separate ova, or from two ova, one of which has a double germinal area.

The binovular twins are at least six times commoner than the uniovular, and the forms show certain differences.

First, there is the arrangement of the membranes. If the twins grow from two separate ova—which may therefore become implanted in the uterus at some distance from one another—each will have its own decidua basalis, and therefore its own placenta, its own decidua capsularis, and its own chorion and amnion, though as they grow and fill up the uterine cavity the two placentæ may become fused at their edges, and the partition between the two sacs may be broken down—perhaps by kicking movements of the fœtus—so that they communicate. Generally, however, the placentæ, even if attached, will be recognized as two, and careful examination of the partition between the two bags of membranes will show that it is made up of four membranes, the amnion and chorion of each twin. At any rate, it will be found to consist of two amnions separated by a layer of chorion, though, owing to the two chorionic membranes being squeezed together, it may not be possible to differentiate them into two. On the other hand, the uniovular twins, as they grow from a single ovum, have only one decidua basalis and therefore only one placenta, and a common decidua capsularis and chorion, but there will be two amniotic sacs, unless the partition has been broken down, and the partition will consist of two layers of amnion only with no chorion between. Each fœtus will have its own cord, and in the case of binovular twins a separate circulation, but in the uniovular twins the cords may fuse near the placenta, and the circulation of both fœtuses may mix in the placenta. Uniovular twins are always of the same sex and exhibit a very marked likeness to one another. Binovular twins may or may not be of the same sex. Sometimes in the case of uniovular twins one is not so well developed as the other, and this may go to the length of one being only partially developed, acephalic (with no head), or anencephalic (with no brain or vault to the head), and so on to various forms of monstrosity. This is due to the mixing of the two circulations and to one twin obtaining more than its due share of nutrition. Again, one fœtus may die early in the pregnancy and become dried up and flattened out by the growth of the other into a mummified or papery form, "fœtus papyraceus," which is generally born with the membranes after the living child.

Identical twins are a special and very rare variety of uniovular twins, formed by division of the zygote, *i.e.* after fertilization. They have the same chromosome constitution (p. 75), hence their name. Sometimes the division between the two is incomplete, giving rise to the various forms of conjoint twins, like the Siamese twins, or to attached portions of another (parasitic fœtus). Twins of this kind not only resemble one another very closely in appearance, but also in other characteristics of mind and body.

Course of Twin Pregnancy.—This may be no different from a single pregnancy. The uterus may appear no larger—for the children in twin births are usually smaller than in single births, and the amount of liquor amnii is a more important factor in determining the size of the uterus. But if the uterus is markedly enlarged by the

presence of twins, the mother will suffer more than usual from pressure symptoms, swelling of the lower limbs, vulva, and abdomen, varicose veins, piles, etc. Hydramnios is common in uniovular twins, developing in the sac of the child with the stronger circulation. There is an increased tendency to the development of albuminuria and the other manifestations of the toxæmia of pregnancy (p. 224).

Labour is frequently premature and complications are more common in twin than in single births.

Presentations.—In about half the twin labours both children present by the vertex; in about one-third, one child presents by the vertex and the other by the breech; the remainder by head or breech and transversely, or both transversely.

The diagnosis of twins may be easy or difficult. When the fœtuses lie in the uterus alongside of one another, the diagnosis may be quite easy; when one sac is in front of the other, the diagnosis may be impossible till after the birth of the first child. The uterus may be unusually large, but this may be due to excess of liquor amnii or a very large child. A girth at the umbilicus of over 40 inches would point to twins or hydramnios. Excess of liquor amnii may be suspected from the elastic feel and the way the fœtal parts ballott in the fluid. On the other hand, if the fœtuses are small and there is no excess of fluid, the uterus may not be unduly enlarged. On abdominal examination two heads may be felt and two backs, or an unusual number of small parts and a wide distribution of fœtal movements. If two heads can be made out distinctly, say one at the brim and another at the fundus, or two at the brim, one on each side, the next thing is to try and find the back belonging to each fœtus. One back may be found running up the left side of the uterus and the other the right side, with a groove between. Vaginal examination may show one head engaged in the brim whilst another head can be felt above the brim or in the fundus uteri, but it must be kept in mind that it is not always easy to make certain that it is a head in the fundus when there is a head below. The breech in the fundus may be mistaken for a head (p. 169).

The fœtal heart sounds give very valuable help. There may be areas of maximum intensity at some distance apart; for instance, one below the umbilicus to the left and one above and to the right. In such a case it is unlikely that they are the sounds of the same heart conducted to different spots. To make quite certain, it is necessary to count the heart sounds and find they are beating at different rates.

After the birth of the first child the fundus uteri remains above the umbilicus, and palpation shows the presence of a second child. This will be confirmed on vaginal examination by finding a second bag of membranes and presenting part.

Prognosis.—There is a slightly increased risk to the mother, because complications are more common—malpresentations, locking of one twin with the other, uterine inertia from increased distension of the uterus leading to slow labour and increased risk of postpartum hæmorrhage in the third stage, and sepsis in the puerperium from consequent internal manipulations. With good management these risks are not serious.

In the case of the children, there is a decidedly increased mortality from the frequency of premature and weak children.

Labour with Twins.—The first stage is often slow, owing to uterine inertia, but as the children are usually small, this often compensates for weakness of the pains. After the first child is born there is generally an interval of fifteen minutes to half an hour, while retraction of the uterus goes on before the pains return. The second child is born quickly, because the passages have already been dilated by the first, and the placentæ and membranes of both generally follow the birth of the second child. In rare cases the placenta and membranes of the first child may be born before the second child.

Management of Twin Labours.—As in many cases the presence of twins will only be known after the birth of the first child, nothing need be said about the management up to this point.

In tying off the first child, ligature the maternal end of the cord also with equal care, as possibly with uniovular twins the second may bleed through the cord of the first. Examine carefully the lie of the second child; if it is transverse,

assistance must be obtained at once. If it is lying longitudinally, wait for the return of uterine contractions, and meantime listen to the fœtal heart sounds and keep them under observation. Slowing, irregularity, or marked rapidity indicate sending for medical help. If uterine contractions do not come on in an hour's time, examine and see if the second bag of membranes is unruptured, and, if so, rupture it and again await uterine contractions. If pains are absent or feeble, try stimulation of the fundus by massage and friction ; if still there are no pains (which will be very unusual), watch the fœtal heart, and if it is regular and strong, continue patiently to await contractions.

During the birth of the second child follow down the uterus and be ready to massage the fundus if it should feel soft and flabby. The placental area is much larger than normal and the uterus has to retract more than usual to control bleeding—hence the guiding principle in the management of these cases is to give nature time, and not to hurry matters.

Everything ought to be in readiness for the treatment of postpartum bleeding (p. 217). The second child will have to be delivered quickly if its cord prolapses or there is antepartum hæmorrhage from premature detachment of the placenta of the first child or of the united placentæ, or if there are signs of fœtal distress on listening to the heart. For these conditions, send for the doctor and meantime apply emergency treatment as directed for such complications in single births. The third stage must not be hurried and must be carefully managed in the ordinary way, and the midwife must remain longer than usual after the labour is over—an hour and a half to two hours—to be certain that retraction is complete and that there is no bleeding. The patient's pulse rate ought to be noted at intervals. Special care ought to be taken in the examination of the placenta and membranes and a note should be made as to the arrangement of the sacs.

It is said that the first child and its placenta and membranes may be born and the second child yet remain *in utero* for days or weeks, but this is so extraordinary an occurrence that the midwife need not consider its possibility. There have been cases, however, where the mother has been able to claim two maternity benefits, because a second confinement has occurred after recovery from the first.

A rare form of obstructed labour may arise with twin labours by the heads of the two small or premature fœtuses locking with one another, or the aftercoming of the first with the forecoming head of the second, and so on. If this did occur, the signs of obstructed labour would develop (p. 194), and medical help should be summoned at once. If the doctor is a long way off, the midwife should try and push up the obstructing part of the second child.

CHAPTER XVIII.

PROLONGED LABOUR.

Labour in any or all of its stages may occupy a much longer time than the average without harm to mother or child, so that it is impossible to draw a hard-and-fast line beyond which labour is to be considered as prolonged. If the delay is such as to produce signs of physical or nervous strain in the mother or affect the fœtal heart, the labour must clearly be considered as abnormally protracted.

Labour may be prolonged because of—

1. Faults of the powers—uterine or auxilary.
2. Faults of the passages—bony or soft.
3. Faults of the passenger—the fœtus and its envelopes.

The first will give rise to delay, because of a failure of power in the machine, and the other two because the resistance is too great, *i.e.* too heavy a load is put on the machine, and the pupil will see that the chief problem in recognizing the causes of delayed labour is to decide in which of these two categories to put the case, whether it is one of failure of power, *i.e.* inertia, or one of too great resistance to be overcome, *i.e.* obstructed labour.

At the same time, it must be understood that all cases will not fall into one or other of these categories, indeed very many cases of protracted labour are due to a combination of these causes—the power is relatively weak for the work to be done. The power would suffice if the load was a light one, but is insufficient to effect delivery when the load is a heavy one, or can only do so after very prolonged effort. The problem then becomes one of estimating how much of the delay is due to the one factor and how much to the other, and this is an important matter, because the second category, that in which the resistance is too great, is much more serious and more exhausting to the patient than the first.

The classification given above will be found most useful by the student in working out the causes of delayed labour at an examination.

A.

DELAY DUE TO WEAKNESS OR FAILURE OF THE POWERS.

I. Inefficiency of the Auxiliary Powers.

Inability to assist the uterus by bearing-down efforts may arise from—(1) Over-stretched and flabby abdominal muscles, from repeated labours or over-distension ; (2) over-distension of the abdomen, from the presence of ovarian tumours, full bladder, dropsical fluid, and the like ; (3) exhaustion and tiredness at the end of a long labour ; (4) nervousness and anxiety ; (5) general weakness due to disease ; (6) shortness of breath from chronic bronchitis, heart disease, etc.

The absence of bearing down will cause delay in the second stage, especially the later part, but if the uterus is acting well this is not usually serious. The mid-wife should endeavour to discover the cause, and if it is due to exhaustion, give the woman time to rest and recover her strength ; if she is nervous and worried, en-deavour to reassure her. A binder will be useful in cases of flabby abdominal wall due to multiparity. In many cases she can give valuable help to the patient by " working with her," that is, when she has a pain pressing strongly on the fundus,

and so trying to help delivery by expression. She then does very much what the patient herself does with each bearing-down effort, *i.e.* presses down the uterus and child. It is exhausting to the attendant and ought only to be done when other methods fail and the birth is near at hand.

When the patient cannot bear down because of shortness of breath, medical assistance ought to be summoned, as it may be advisable to have the patient delivered quickly to save strain on the heart.

II. Weakness or Failure of the Uterine Powers.

Under the term " uterine inertia " it has been customary to include two distinct causes of delay in labour, the common one from weakness of uterine action, distinguished as primary inertia, and the other and very rare from failure of uterine action, distinguished as secondary inertia. The use of the word " inertia " for two different conditions is confusing, and the qualifying adjectives " primary " and " secondary " only make the confusion worse. If any meaning is to be attached to " primary " it is that the inertia is not due to any outside cause but is primarily in the uterus itself. As will be seen later, primary inertia is very rarely an inherent vice of the uterine muscle but is commonly dependent on some cause, often one altogether outside the uterus. As these terms are misleading and have not even the excuse of being hallowed by long usage, a simpler and more descriptive nomenclature is justified. Inertia without any qualifying title may be reserved for weakness of the pains, and exhaustion of the uterus for failure of uterine action. In departing from the usual terminology, however, the pupil should be warned to keep in mind " primary " and " secondary " uterine inertia and to be prepared to recognize them if she meets them at the examination, though she may drop the acquaintance as soon as that ordeal is happily over. It is as well that she should also know that some attach the term " secondary " to what is perhaps the commonest type of failure in function, the non-development of the strong expulsive contractions that normally arise with distension of the outlet. Indeed, the whole terminology of defective uterine action is greatly in need of being clarified.

Uterine Inertia; Weakness of Uterine Power. — The definition of primary inertia commonly given by candidates at the examination does not cover all cases of inertia as seen in the labour room. The usual answer is that it is " pains weak from the start " or " weak all through labour," which may or may not be the case. Sometimes the contractions are good at first, but after full dilatation may not increase to the strong expulsive pains characteristic of the second stage, so that uterine action is weaker than normal. Such weakness of uterine power is the usual reason for instrumental delivery, and the commonest time is when the head is near the outlet, *i.e.* the low forceps operation (Chap. XXX.). In many such cases the labour may have gone on well till the head has reached the outlet, but the uterus has not the power to overcome the final obstacle, the levator ani muscles surrounding the vulva (cp. Fig. 29), within a reasonable time. The only definition of inertia that will cover all cases is that the uterine contractions are below the average in strength, either throughout labour or during some part of it, so that the labour is prolonged owing to their being ineffective for what they have to do.

Inertia is more often met with in primiparæ, probably because of the emotional effect of anxiety and dread and because the greater resistance of the soft parts tires them sooner, but it also occurs in multiparæ, especially when they have had many children in quick succession. The factors already mentioned as inhibiting uterine action (p. 96) are often productive of inertia: a nervous and excitable temperament, fatigue and want of sleep, a loaded rectum and distended bladder, overdistension of the uterus, as from hydramnios, twins, or fibroid tumours, and loss of the stimulating action of the bag of waters from early rupture of the membranes, especially if not immediately followed by descent of the presenting part. Inertia may occur in strong healthy women without obvious reason.

The condition is one which is usually recognized easily. The pains are often feeble from the beginning; the hand placed on the uterus notes that the contraction is of short duration and not strong; the intervals between the pains are long, the

rhythmical character is not obvious, and labour progresses slowly. The woman may be emotional and complain much and loudly, or she may be quiet and feel very little. She may be tired and worn out by the long labour and want of sleep, but as there is little uterine activity to exhaust her and no injurious pressure on the soft parts, there will be no rise in the pulse rate or temperature, or at most of a trifling degree, unless in cases of extreme prolongation. For the same reason the fœtal heart will remain unaffected unless the waters drain away. The essential point in diagnosis is that the nature of the contractions shows the reason of the delay. In the absence of good uterine function, progress cannot be expected. Hence the importance of careful observation of the pains.

Prevention and Treatment of Uterine Inertia.—(*a*) *In the first stage.*—Any obvious cause of weakness of the pains which can be remedied must first be removed. The bowels must be emptied and a watch kept for signs of distension of the bladder; officious friends and visitors must be refused admission to the lying-in room and any source of excitement or worry to the patient removed. The midwife should do all she can to reassure her and quiet her fears, and refrain from needless examinations, especially vaginal examinations, which will only further disturb the patient's peace of mind. The fussy attendant, who has little confidence in herself, will quickly infect her patient with her own anxieties. To maintain her strength, she should be given small quantities of milk, soup, gruel, or such-like, and very often a cup of freshly made tea has a useful sedative effect. When it can be given, a hot bath may stimulate uterine action. The woman is best walking about the room, but if she has been kept awake all night by occasional pains and the fear of her approaching labour, she should be put to bed, with the room quiet and darkened, and encouraged to sleep. A drink of hot milk or a sedative mixture will help her to sleep. A protracted first stage will tire the patient, and is likely to be followed by poor expulsive action, possibly calling for instrumental delivery, therefore to prevent failure of function later, it is essential that the woman is not allowed to become fatigued. If sleep is not obtained by simple measures, a sedative (opium or chloral (see p. 303)) ought to be given when she is *tiring*, but before she is *tired*.

If the membranes are unruptured, there is no danger to mother or child, and there is no need for any active treatment. If the membranes have ruptured early and the os is tight and rigid—a condition which often accompanies weak pains, for feeble contraction of the upper segment is accompanied by poor dilatation of the cervix and lower segment—a hot vaginal douche of sterile water up to 116° F., if the patient can bear it, will aid softening and relaxation of the cervix and stimulate uterine action. If it is effective in exciting pains, it may be repeated in two hours' time. An enema of hot water is also a good stimulant to the uterus. Sometimes contractions of short duration at irregular intervals may be present, causing great pain and distress to the patient without producing any effect in dilating the os. This "colicky" action of the uterus, as it has been aptly termed, is most often seen in nervous and excitable women; an opiate or some other sedative generally results in strong and regular pains being established.

As danger to the mother and child may be said to commence from the time of rupture of the membranes, the midwife must be on the watch for any signs which may warn her of trouble. Frequent observations of the maternal pulse should be made, and the uterus examined through the abdomen to see that it is quite soft—a hard uterus contracting down on the child would indicate draining away of the liquor amnii and abnormal retraction of the uterus. The fœtal heart rate, also, should be observed at intervals. Medical help should be summoned before signs of maternal and fœtal distress are obvious, and should be obtained in all cases in which the head is not deep in the pelvis or slow progress follows rupture of the waters. One thing the midwife must make sure of in a slow first stage is that the delay is due to weakness of the pains and not to any malpresentation or other obstruction. When this is certain there is no need for anxiety, for prolongation of the labour due to weak uterine action will not cause injurious pressure or serious general disturbance.

(*b*) *In the second stage* the pains ought to become stronger and be accompanied by bearing-down efforts, and uterine inertia may show itself in this stage by there being no strong second stage pains and by feeble straining. The midwife must

keep her patient under close observation during the second stage, for weakness of the pains is by far the commonest indication for forceps delivery, and therefore the midwife must be on the watch so as to be able to decide when the time has come to obtain assistance for her patient. Roughly speaking, by two hours after full dilatation of the os the child should be born. In multiparæ this length of time will not usually be reached, in primiparæ it will often be exceeded and without harm to mother and child. The question of interference cannot be decided by the clock, but when two hours of the second stage have passed the midwife must seriously consider the possibility of forceps delivery being necessary. In many of these cases the resistance of the perineum and soft parts at the outlet is greater than usual, and as the uterus is sluggish and does not respond to the stimulation of the distension of the perineum by strong pains, it may not be able to overcome this final obstruction till the mother is tired out. The common sign of this is that the head descends with each pain and stretches the perineum, but recedes again as the contraction passes off.

It is not possible to give precise instructions as to when to send for assistance in delay due to inertia in the second stage, as the line between the cases in which delivery may be left to nature and those in which assistance is required is far from definite, and individual medical practitioners will differ as to the time at which it is advisable to end the labour. Indeed, given time, the patients would deliver themselves, but after a long and exhausting labour from which their recovery would be slow and with more damage to the perineal muscles and uterine supports than need be, and the child also might suffer from the prolonged labour. And it is not fair to deny to the mother the advantages of an early delivery and cessation of pain which chloroform and forceps can bring her. Sometimes an intramuscular injection of pituitary extract will suffice to strengthen the pains so as to effect delivery in a few minutes. The following considerations will help the midwife to decide when to call the doctor. If the pains are feeble and at long intervals, the uterus soft, the mother's pulse good and not fast, the fœtal heart beat not affected, the head movable and no large caput has formed, the best thing is to try and get the patient to sleep. There are no exhausting pains and no great pressure, and good uterine action will follow a rest. Make the room quiet and dark and give the patient a hot drink and a sedative draught,[1] and wait for stronger pains. Often a report containing exact particulars of the case will be sufficient to show the doctor that it is one of delay due to inertia, and a sleeping draught will be sent. If the head is low down and visible at the outlet with each pain, and there is no œdema of the vulva or general signs of distress in mother or child, the delay is evidently due to the rigidity of the perineum and the absence of the strong uterine contractions that usually effect the birth of the head. Here probably a little more power will suffice for the birth of the head. Encourage the patient with her bearing-down efforts and "work with her," placing the hand over the fundus and expressing strongly with each pain. If progress, even though slow, is being made, the birth will not be long delayed. If after two hours in the second stage the head is still in the cavity of the pelvis and not showing at the outlet and pains are present, it will be best to get assistance at once. At this rate of progress it will be several hours more before the head is born. If the patient is so worn out by her labour that a rise in the pulse rate is noticed, if there is any swelling of the labia or perineum, and any slowing of the fœtal heart, passage of meconium, or the formation of a large caput, the midwife has already delayed too long in sending for assistance. Œdema of the vulva is due to the prolonged pressure of the head on the maternal veins and is an indication for delivery; a soft œdematous perineum tears readily. All this may be summed up by saying, that if two hours have elapsed since full dilatation, and the rate of progress is so slow that it is evident that delivery is not imminent, then advise that a doctor be summoned, and always keep a close watch for the signs of fœtal and maternal distress which indicate that labour should be terminated at once. The C.M.B. Rules give no instructions as to obtaining assistance in protracted labour (as it is beyond the wit of man to put them into "rules"), so these suggestions are given as a general guide to the midwife in practice.

[1] In the note on Drugs, pages 302–303, will be found information as to sedative draughts suitable for use by the midwife,

Failure of the Uterine Powers; the Atonic or Exhausted Uterus.—The condition of uterine atony or exhaustion, often termed secondary inertia, is as rare as weakness of the pains is common. When fully developed there is complete paralysis of uterine activity, the functions of contraction and retraction being both lost. The uterus forms a soft flabby bag which will neither contract spontaneously nor on stimulation, and will not retract if emptied of its contents. It behaves as if its nervous mechanism was paralysed and its muscular structure had lost all tone. That some such condition is possible is borne out by its occurrence in extreme shock and in patients dying from hæmorrhage in the second stage of labour, when the laxity of the uterus may be so extreme that the fœtus may feel as if it was free in the abdomen.

Uterine exhaustion is more common in multiparæ and in those who have had many pregnancies in quick succession; serious loss of blood from antepartum hæmorrhage, especially concealed accidental hæmorrhage with distension of the uterus with blood (p. 212), over-distension of the uterus by hydramnios or twins, grave constitutional disease, shock and exhaustion, sepsis and prolonged deep anæsthesia may all predispose to its occurrence. In nervous and emotional women strong pains may produce extreme prostration with loss of contractile and retractile power in the uterus for a time. When there is increased resistance to the passage of the child and the uterus has made strenuous but ineffectual efforts to expel the fœtus, it may arise as the result of nervous and physical exhaustion; after the expulsion of the child and even after effecting the birth of the placenta, exhaustion of the uterus with complete loss of its contractile and retractile power may occur (p. 216). It bears the same relation to inertia as intestinal paresis does to constipation or sluggish action of the bowels. In these cases the pains in the earlier part of the labour may have been strong and frequent, and then, owing to the exhaustion produced, have ceased entirely. It may, therefore, be met with in the course of obstructed labour (p. 194), though its effects on the uterus are just the opposite of those ultimately produced by obstructed labour. It will result in postponing the onset of the effects of obstruction.

Exhaustion of the uterus, secondary to powerful contraction, may be a more advanced stage of weakness of the pains arising in a patient tired and worn out by a tedious labour. The distinction may be likened to that between a long-distance runner finishing slowly but keeping his feet (inertia) and one who falls in a faint or whose legs suddenly give way under him with complete loss for the time being of all power over them (exhaustion).

The exhausted uterus may be recognized by a complete cessation of all contractions and by its becoming so soft and relaxed that its outlines can only be detected with difficulty, while the fœtal outlines can be made out with unusual distinctness. The presenting part may recede owing to the absence of retraction. In itself it produces no serious general symptoms in the mother, though it frequently arises when the mother's condition is serious and the hæmorrhage which follows its occurrence in the third stage will be extremely dangerous (p. 216). Rupture of the uterus is the condition most likely to be confused with it. Both may occur during obstructed or difficult labour and follow on strong uterine action; in both the presenting part may recede and the fœtal parts be unusually readily felt through the abdominal wall; bleeding with shock and exhaustion may be present in both. The sign which differentiates them is that the hard retracted body of the uterus can be felt as a separate mass in the abdomen in cases of rupture. The serious symptoms in rupture often occur suddenly (p. 197); in exhaustion the onset of symptoms is more gradual. In the third stage of labour the corresponding distinction is between atonic and traumatic postpartum hæmorrhage, and is made as described on page 222 by the uterus forming a soft flaccid bag in the former case and being hard and retracted in the latter.

In most cases the midwife will have already obtained medical assistance for some predisposing complication—antepartum hæmorrhage, over-distension of the uterus, or obstructed labour. Help should be obtained early in every case in which there are strong pains without rapid progress, as their continuance will tend to produce uterine exhaustion or tonic contraction. Exhaustion of the uterus will not arise in the first stage apart from some complication urgentfy demanding medical

aid ; should it arise in the second stage the patient must be given restoratives and a sedative to induce sleep, as rest is absolutely essential to allow the uterus to recover its tone and power of action ; delivery under such conditions would result in postpartum hæmorrhage, as the natural means of controlling the bleeding are absent. In the third stage the treatment is that of atonic postpartum hæmorrhage, fully discussed on pages 216–221.

B.

OBSTRUCTED LABOUR.

The term has come into general use, though it is not easy to give a precise definition of all that is included under it. It has already been stated that when labour is protracted, not because of want of power but because the resistance is too great for the natural forces to overcome, the case is one of obstructed labour. Any abnormality of the passages or passenger which renders delivery by the natural forces impossible will, if unrelieved, lead to a definite train of symptoms which will end in rupture of the uterus, death of the child, and probably of the mother also. Early recognition of these symptoms is therefore a matter of prime importance, as two lives depend on timely assistance being obtained.

The subject is best considered under the following heads :

I. The causes of obstructed labour.
II. The clinical features of obstructed labour ; tonic contraction.
III. The diagnosis of obstructed labour.
IV. Impaction of the presenting part.
V. The results of neglected cases of obstructed labour.

I. The Causes of Obstructed Labour.

These are comprised under the last two groups mentioned under prolonged labour (p. 188), faults of the passages and passenger. Under faults of the passages, the bony passages provide one of the most important causes of obstruction in contracted pelvis (p. 199) ; bony tumours of the pelvic bones may give rise to the same difficulty as contraction, but they are extremely rare.

The soft passages occasionally form a source of obstruction ; tumours, such as uterine fibroids in the lower segment or cervix ; cancer of the cervix, or an extreme development of scar tissue from old laceration, and very rare conditions of partial occlusion of the vagina may prevent the passage of the child, but, generally speaking, an active uterus is able to overcome the resistance of the soft parts.

The faults of the passenger which may give rise to obstruction are many. Too large a child, from postmaturity or other cause, a large head, from the same cause or from hydrocephalus, other fœtal malformations, difficult occipito-posterior positions (p. 153), persistent mento-posterior positions (p. 159), brow presentations (p. 162), transverse lies (p. 180), impacted breech (p. 173–4), locked twins (p. 187), may be mentioned as possible causes. For the most part they have been described elsewhere and reference need only be made to the pages indicated, but the postmature fœtus and hydrocephalus have not been mentioned. The postmature fœtus is one that has been carried *in utero* beyond the normal duration of pregnancy—sometimes a month or six weeks after the calculated time. It is larger, heavier, and the bones are more firmly ossified than normal, and hence it may give rise to very great difficulty, not only from its size but because moulding of the head cannot occur. In hydrocephalus, the head is greatly increased in size from distension of the brain with fluid—water on the brain. It may be detected on abdominal examination by finding the head much larger than usual, softer, and not engaged. Breech presentation is common with hydrocephalus, and the head in the fundus is difficult to detect because of its softness, so that the condition may not be recognized till the body is born. If the head is presenting and can be reached by vaginal examination, the bones will be felt widely separated so that they move on one another ;

the fontanelles and sutures bulge with a pain and may feel like the bag of membranes. If the condition is recognized, medical assistance should be obtained at once.

II. The Signs and Symptoms of Obstructed Labour.

First, let us consider what will happen in the event of the uterus being given a task which it cannot perform—say, a case in which, owing to large size of the head or small size of the pelvis, it is impossible for the child to be born naturally.

The membranes are likely to rupture early, because the head cannot sink down into the lower uterine segment and keep the general intrauterine pressure from the weakest part of the bag of waters. Hence the bag tends to protrude in a long finger-like process and to burst early. Also, because the head does not fill up the lower uterine segment, the waters drain away completely, and the cord, and sometimes a limb, may prolapse into the vagina. And, further, because the head cannot get down into the cervix to complete the dilatation, there may be some delay in the final drawing up of the last rim of cervix; indeed, if the head is jammed firmly against the symphysis, the anterior lip may be nipped between it and the head, and, becoming swollen and œdematous, hang down in front of the head, so that the drawing up of the cervix is often incomplete. It is in the second stage of labour that the marked features of obstructed labour develop. With the complete escape of the liquor amnii the uterus retracts down on to the fœtus so that it clasps it tightly. The head is pressed tightly down on to the brim, the breech is in the fundus, tightly clasped by the uterus. The child cannot be lessened in size, and yet with the continued contraction and retraction of the upper uterine segment, that part of the uterus becomes shorter and narrower and its walls thicker and harder. To make up for this the lower segment is stretched more and more and its walls are thinned. This condition is known as *tonic contraction* or *tetanus* of the uterus, and is so called because the retracted uterus is moulded on to the child and its walls are so thick and hard that no relaxation can be felt, so that it appears to be in a state of continuous contraction or tetanus. It is really over-retraction of the upper segment and over-distension of the lower segment. Supposing such a case was left and carefully observed, the following signs would be found. The thick, hard, non-relaxing upper uterine segment would prevent any of the fœtal parts being recognized on abdominal palpation, though just at the pelvic brim the thinning of the lower segment might allow the head to be unusually easily palpable. A little above the symphysis would be felt a ridge where the thinned-out lower segment passes into the thick upper segment. This ridge is known as the retraction ring or Bandl's ring, because it runs right round the uterus at the level of the junction of the two segments (Fig. 90). At first it will be but slightly marked, but as the labour goes on it will become more and more evident and will rise up towards the umbilicus as the upper segment becomes shorter and the lower stretches and thins. The presence of a retraction ring is a sign of impending rupture, and the further it is felt above the pubes the nearer is the uterus to rupturing. Unless the child is very small it will rarely be felt as high as half-way to the umbilicus. Rupture occurs in the thinned-out lower uterine segment, most commonly in its posterior wall, where the stretching is greatest. The fœtus is expelled into the peritoneal cavity, where it can be felt very easily and the retracted upper segment is felt as a separate mass just like the uterus in the third stage of labour. The length of time the labour will last before this catastrophe occurs will vary greatly, but it depends principally on one factor, and that is the strength and frequency of the pains. If the uterus is acting very powerfully, it may pass into tonic contraction a few hours after rupture of the membranes, for the stronger and more frequent the contractions, the greater will be the retraction, and the sooner will the uterus shrink down on to the fœtus. If, on the other hand, the pains are feeble and at long intervals, retraction will be slight and the patient may be several days in labour before the stage of tonic contraction is reached. Especially will this be the case if the uterine muscle becomes exhausted and all activity ceases for a time (p. 192), for during those intervals no retraction will take place. When it recovers and begins to contract again, retraction without advance of the child

will also begin. When once the uterus has reached the stage of tonic contraction, it rapidly progresses towards rupture. Tonic contraction is very rare indeed in any country where medical assistance is readily obtained. When ergot used to be given to hasten delivery it was much more common, as ergot produces that prolonged contraction so valuable for controlling bleeding, but, if the child is not born, cutting off the maternal blood supply to the placenta and encouraging tonic contraction.

Another type of case is that of impaction of the head in the pelvis ; it may arise in occipito- and mento-posterior positions, and brow presentations, and in those rare cases of contraction of the outlet without contraction of the inlet. The hard head is jammed into the pelvis, it squeezes the soft parts of the mother between it and the bony wall, and neither descends with the pains nor goes back in the intervals. It is fixed or impacted in the pelvis. What happens in such cases ? The continuous pressure impedes the circulation through the maternal tissues and they become œdematous and swollen, just as the leg swells when its circulation is interfered with by too tight a garter. Hence the labia and vulva become swollen, hot, and dry. If the impaction is not relieved, the compressed parts will slough, or die, from the complete stoppage of the circulation. When this begins the discharge from the vagina may become offensive, and the patient's general condition serious, as shown by the anxious expression, the rapid pulse, and the other signs already described. By listening to the fœtal heart at intervals, it may be found that the rate is slowing, indicating fœtal distress and the necessity for rapid delivery if the child's life is to be saved. The child's head shows the signs of compression, too, in the overriding of the skull bones and the formation of a big caput succedaneum. Assistance ought to be obtained long before this stage is reached. The occurrence of strong pains with little advance of the head, the formation of a large caput, the head becoming fixed, the swelling of the maternal parts, and the increase in the pulse rate should have warned the midwife of the need for help.

The effect of obstructed labour on the mother and fœtus and the symptoms and signs that develop during its progress must now be considered. With strong and frequent pains and no descent of the presenting part, the mother will exhibit signs of exhaustion. There will be a steady rise in the pulse rate ; the respirations will become hurried and the temperature will rise. As time goes on, her tongue and lips will become dry, her eyes and cheeks sunken, her expression anxious, and her aspect one of serious illness. She will be restless and complain of severe abdominal pain, and, on examination of the abdomen, the uterus will be found tender and hard, and if the case is at all advanced there will be no recognizable relaxation. Before passing into tonic contraction the uterus will be irritable, contracting on the slightest manipulation, and the intervals of relaxation will be short. By this time it may not be possible to define the fœtal parts, owing to the hardening and thickening of the uterine wall. No fœtal movements will be felt either by the mother or by the examining hand, nor will the fœtal heart sounds be heard, as the child will be dead. The death of the child is brought about by the excessive uterine retraction interfering with the maternal circulation to the placenta. It has already been explained that the circulation to the placental site is checked by the pressure of the contracting muscular fibres on the vessels leading to it, and is in fact the natural means of preventing hæmorrhage after labour. In normal labour the circulation is re-established during the intervals between the pains. In an advanced case of obstructed labour, when there is over-retraction, the placental circulation is cut off so that the child dies. If the fœtal heart is listened to at intervals, the heart beats are usually noticed to become slow and irregular and finally to cease altogether. The warning signs of fœtal distress are a gradual slowing of the heart sounds to 120 and under ; sometimes, however, they become rapid and difficult to count—over 160 spells danger. Convulsive movements of the fœtus and the passage of meconium in vertex presentations are usually signs of impending fœtal death. Later on the retraction ring will be felt running obliquely across the uterus ; to the hand passing down from the thick upper segment on to the thinned-out lower segment, it will feel like a groove or depression ; to the hand passing up from the thin lower segment, it will appear as a ridge. If the patient is untreated, the ridge will become more marked and will rise higher in the abdomen till rupture of the uterus occurs.

On vaginal examination the presenting part will be high up with a large caput, the vagina will be hot and dry, and there may be an œdematous anterior lip of the cervix.

A rare cause of delay is the formation of a contraction ring, usually as the result of prolonged intrauterine manipulation to effect delivery; it is a localized contraction of the uterus of an hour-glass type formed over a depression in the child's body, often the groove between the head and the trunk, or below the head, producing a constriction gripping the fœtus or preventing its advance. It should not be confused with the retraction ring. The uterus is not hard and relaxes between the pains; the contraction ring cannot be felt through the abdomen, but only by the whole hand being passed into the vagina and feeling the constriction from within. Morphia and chloroform generally cause it to relax, but sometimes it has to be manually dilated or incised.

III. The Diagnosis of Obstructed Labour.

It is most important that help should be obtained early in all cases of obstruction. As time goes on, the treatment of the case becomes more difficult, and, with a strongly contracting uterus, tonic contraction may develop rapidly.

First of all, the midwife will probably recognize the cause of the obstruction, a malpresentation or a contracted pelvis. If so, the presenting part will probably be high up and out of reach. The rules of the C.M.B. state that medical assistance must be summoned for deformity or stunted growth (contracted pelvis), if there is a malpresentation, if the presentation is other than the uncomplicated head or breech, and where no presentation can be made out (E 21 (2) and (3)). This means that in the majority of cases help will be obtained not because there are any symptoms of obstructed labour, but because some condition is found which in time would give rise to the symptoms of obstruction. But besides these cases there are others in which the cause of the obstruction is not at once evident. There may be a slight contraction of the pelvis, not sufficient to be easily recognized, and at the same time a large head, also not easily determined, and the combination of a large head with a small pelvis may suffice to form a serious obstruction. With a normal pelvis, a large and firmly ossified head or an occipito-posterior position with extension of the head is a possible cause of obstruction. If the condition was not diagnosed at first, the midwife would recognize it by the course of the labour. There would be no advance of the presenting part, and with good pains this in itself ought to be a sufficient indication that something serious is amiss. Strong contractions ought to mean rapid delivery, and therefore delay in such circumstances must mean obstruction. If the second stage has lasted two hours and the birth is not near at hand, the midwife ought to obtain assistance, and the stronger the pains the more urgent is the need. Throughout labour the midwife must watch the patient's general condition, note the pulse rate, the respiration rate, and the temperature; if the pulse rate is noticed to remain up between the pains and to be increasing as the labour goes on, it means that the woman requires assistance. A rise in the pulse rate from 70 to 90 or 100 always means danger.

If the pains follow one another very quickly and there are but short intervals of relaxation, or if the uterus is very irritable, that is, passes into contraction whenever the abdomen is palpated or a vaginal examination made, the case has become urgent. By this time the anxious distressed appearance of the woman, her restlessness from the continuous pain, the hard tender uterus, and absence of relaxation will show the dangerous stage the labour has reached. Frequent auscultation of the fœtal heart will indicate danger to the child, generally by slowing and irregularity, but occasionally by quickening.

The indications of obstructed labour will thus become evident to a trained midwife long before the stage of exhaustion and tonic contraction is reached, even if the original condition producing it had not been recognized.

IV. Impaction of the Presenting Part.

In some forms of obstructed labour the presenting part passes through the brim of the pelvis but becomes wedged in the cavity, where it becomes fixed and immovable. The head, for example, may get through the brim, and because it is in some unfavourable position, extended or occipito-posterior or both, or because the outlet of the pelvis is narrow, it may become impacted. A face presentation with the chin posterior or a breech with the legs extended may be impacted even though quite low down in the pelvic cavity. In transverse lies the shoulder may become impacted by being wedged into the pelvic brim (Fig. 90). Impaction of the presenting part will give all the symptoms already described on p. 195, but in addition there are certain results special to impaction. A large caput forms on the head and increases in size so long as the child is alive. This must be remembered, as sometimes the large caput simulates descent, by bringing the scalp down towards the vulva. In cases of impacted head especially, the prolonged pressure of the maternal soft parts between the hard head and the pelvic bones leads to death of the tissues or sloughing. It will not be evident at the time, though there may be some dirty fluid exuding from the vagina, but in the course of a few days when the sloughs separate, urine will escape through the vagina, as the parts affected are nearly always those between the head and the symphysis pubis—the anterior vaginal wall and bladder. In such cases the fistulous opening into the bladder may form through the cervix. The first condition is called *vesico-vaginal fistula*, the second *vesico-cervical fistula*.

V. Other Results of Neglected Cases of Obstructed Labour.

Obstructed labour, if neglected, will end in the death of the fœtus and possibly in the death of the mother either from exhaustion or from rupture of the uterus. When the latter occurs the patient suddenly becomes collapsed, the presenting part recedes, and blood escapes from the vagina, though this may be slight in amount. The signs, if the child escapes into the abdomen, have already been mentioned. All the midwife can do while waiting for medical aid is to combat the collapse by hot bottles and stimulants. The patient is certain to die if not treated promptly, and even if treated may die from shock, hæmorrhage, peritonitis, or sepsis.

Great stress has been laid on these signs and symptoms of obstructed labour, because the trained midwife ought to recognize them early in the labour. At the same time it is necessary to warn the midwife not to be in a state of anxiety in every case in which the labour is delayed. In most cases prolongation of labour is due to a combination of the two factors. The contractions are relatively weak to the task they have to perform. There may be a tight fit and increased but not insuperable resistance, so that contractions above the average in power could effect delivery in good time ; but if the contractions are even slightly below the average, delivery will only occur after a protracted labour with fatigue and exhaustion to the patient. The symptoms of obstruction rarely arise till the patient has been a very long time in labour—generally a matter of over a day, but strong pains and no advance ought to make the midwife investigate carefully for signs of obstruction. With feeble and irregular pains progress cannot be expected, nor will signs of obstructed labour occur.

C.

PRECIPITATE LABOUR.

Precipitate labour or too rapid expulsion of the fœtus requires little attention and only brief mention. It is seen in cases in which the first stage of labour is painless, so that the woman does not know she is in labour. The membranes rupture suddenly, and with one strong pain the child is born. It may occur when the pains are very strong and the resistance to the birth of the child very slight, *i.e.* large and easily dilatable passages and a small fœtus. The chief danger is that labour may occur when the woman is in the streets or some public place or where she cannot have proper attention, and the child may be injured through falling on the floor or drowned in the pan of a w.c., or the cord may be torn. To the mother, the dangers are—laceration of the perineum, owing to the head being rapidly forced through the outlet, detachment of the placenta and possibly inversion of the uterus if the child has dropped from the mother while she is in the erect position. If postpartum bleeding occurs, it is more likely to be from lacerations of the cervix or vagina than from the placental site, as if the uterus is contracting strongly enough to expel the fœtus rapidly, retraction will be equally strong and so hæmorrhage will be controlled. However, hæmorrhage is mentioned as occurring in such cases from uterine exhaustion due to its violent action. Serious collapse has been noticed as the result of the rapid emptying of the uterus.

If the patient is seen in a very rapid labour, all bearing-down efforts should be checked and the patient made to call out; the advance of the head at the outlet should be controlled so far as can be. If, as is more usual, the midwife is not called until the child is born, she must do what is required for the mother and child and investigate carefully both patients for possible injuries. Probably the mother has been taken by surprise while at her household duties and in her working-clothes, and perhaps the child born before she could be got to bed. The third stage may or may not be completed. The mother must be got to bed, undressed, the third stage conducted carefully in the usual way, and a thorough investigation in good light made for perineal laceration. The vulva should be carefully cleansed, and if all is well the patient should be treated in the ordinary way and watched for an hour to see that there is no bleeding. The child's cord, which if torn through will rarely bleed, should be ligatured and the child examined for injury. Medical assistance will only be needed if some injury to mother or child is discovered or suspected.

CHAPTER XIX.

CONTRACTED PELVIS AND PROLAPSE OF THE CORD.

When the pelvic measurements in one or more diameters are less than those given as normal (p. 38), the pelvis is said to be contracted. Generally the pelvic measurements are above those given—for they are a low average—and sometimes they are considerably so, but as the patient will have easy labours, these unusually large pelves require no further mention. Far otherwise is it with those pelves in which the measurements are below those given ; there may be grave difficulty in delivery, and in some cases the diminution in the size of the pelvis may be so great that delivery of the child by the natural passages is impossible, even after perforation and crushing of the head, and the only possible means of treatment may be Cæsarean section, *i.e.* cutting the child out of the uterus and delivering through the abdomen.

This important subject will be considered under these headings :

I. Causation and varieties of contracted pelvis.
II. Diagnosis during pregnancy or labour.
III. The course of labour in contracted pelvis.

I. Causation and Varieties of Contracted Pelvis.

Contracted pelvis is caused by faulty development and growth of the bones, due to rickets, tuberculous disease of the hip, spine, sacro-iliac joints, etc., and spinal curvature. In many cases the cause is not evident.

There are three common varieties, and several rare and unusual forms which we need not consider.

1. The *generally contracted* or small round pelvis is one in which the whole pelvis is equally contracted in all its diameters, so that it is quite normal in shape but smaller than the average. It is difficult to say what is the cause in such cases. It may be due to arrested development in childhood from infantile ailments, but in many cases the patients are strong and healthy women with no history of illness in childhood. It may be that as some women have hands and feet small in proportion to their size, so the pelvic girdle may be small in relation to the rest of the skeleton, though in many of these cases the patient is of small stature. The infantile pelvis and masculine type, in which the pubic arch is narrower and the cavity smaller, are varieties of the generally contracted pelvis.

2. The *flat pelvis* is the next common form of contracted pelvis. Sometimes this form is called the simple flat and the next variety the rickety flat pelvis, but the distinction is of no moment. Probably all flat pelves are due to rickets, though in the slight degrees evidence of it may be unobtainable. But no other disease is known which causes softening and giving of the bones during the years of growth (compare description taken from the Catalogue of the Royal College of Surgeons' Museum, below illustration of simple flat pelvis, Fig. 92). In the flat pelvis the brim is the only part of the pelvis which is contracted, and that only in its conjugate diameter. The promontory of the sacrum is pushed in towards the symphysis, so that the distance between them is less than 4 inches. It is not difficult to understand how this is brought about by rickets in childhood. The pelvic girdle transmits the weight of the trunk from the spine to the legs ; if a child with imperfectly hardened bones is on its feet, the weight of the trunk will tend to press the promontory down towards the pubes. It will in fact tend to make the pelvic brim "buckle," to borrow a word usually applied to an unfortunate bicycle wheel. If this buckling takes place, not only will the pelvis be narrowed from back to front,

but it will be widened from side to side. And this is what is found in all but the minor degrees of flattened pelvis—the conjugate is diminished and the transverse increased. The measurements in the cavity and outlet are not diminished, indeed they may be increased, so that the difficulty in the labour is over so soon as the head is through the brim. It is in this type of pelvis that the hanging-leg position (Walcher's) is of value; the weight of the legs causes the pelvis to rotate at the sacro-iliac joint (p. 68) so that the symphysis sinks away from the promontory thus enlarging the true conjugate by $\frac{1}{4}$ to $\frac{1}{2}$ inch. As soon as the head is through the brim this position must be discontinued as it is no longer advantageous (see Fig. 118, p. 309).

3. The *small flat* or generally contracted flat pelvis is the one which gives the most extreme degree of contraction met with in this country, and is due to severe rickets in childhood. Not only is the sacrum sunk forward into the brim, but the whole pelvis is stunted in its development so that there is general contraction as well

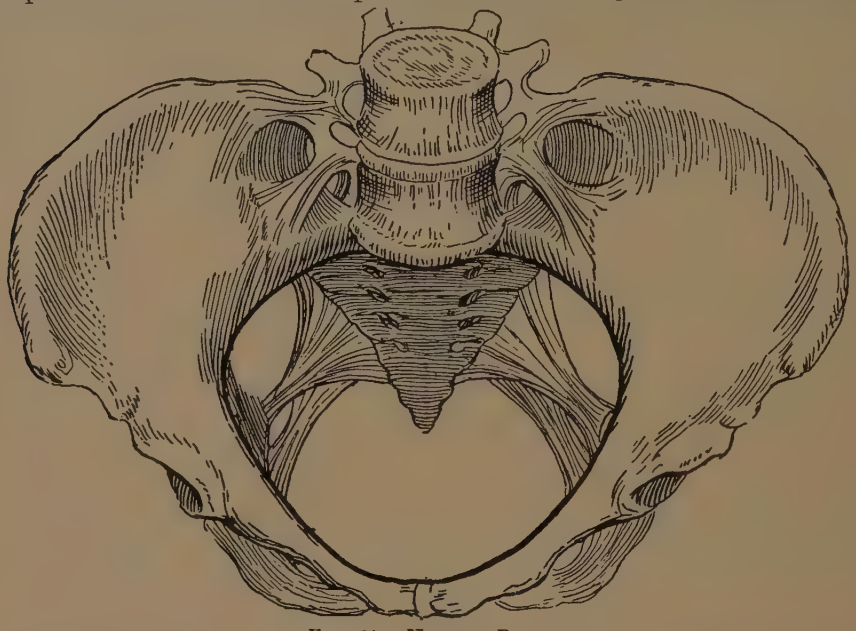

Fig. 91.—Normal Pelvis.

For comparison with the contracted pelvis in the two following figures. A generally contracted pelvis is of the same shape as the normal but smaller in all its diameters.

as flattening. The brim is kidney-shaped, the conjugate narrow, and the transverse widened in proportion. With the rotation forwards of the sacral promontory the posterior iliac spines are pulled in towards one another and the anterior spines rotated outwards, so that sometimes the interspinous diameter is equal to, or even greater than, the intercristal. The cavity is roomy in comparison to the brim, and the outlet also, because the ischial tuberosities are wider apart and the pubic arch widened. The patient is generally undersized, with marked signs of rickets. Well marked cases of this deformity of the pelvis can only be delivered by Cæsarean section.

The rare forms of contracted pelvis are deformed by oblique or transverse contraction due to hip disease on one or both sides, spinal curvature, or other deformity. Contraction of the outlet occurs sometimes with a backward curve of the spine (kyphosis) (Fig. 63), in the masculine and funnel-shaped pelvis, but is rare apart from contraction elsewhere.

II. Diagnosis during Pregnancy or Labour.

The diagnosis of contraction of the pelvis is not always an easy matter, and the midwife must keep a sharp look out for anything which may lead her to suspect

its existence. The rules of the C.M.B. tell her to advise the pregnant woman when there is "deformity or stunted growth" to seek medical aid. That is because such patients generally have some contraction of the pelvis; but in many cases the patient may appear quite normal and yet have a narrow pelvis. It is very important that a diagnosis should be made during pregnancy, because treatment, for instance, bringing on labour before full time when the child may not be too large to pass naturally, is possible then and may not be later. The midwife should therefore go through part of the following examination not later than the seventh or eighth month (thirty-fourth week) of pregnancy in all her patients who are pregnant for the first time or have had a difficult labour before.

History.—If the patient is a multipara and gives a history of having had easy labours at full time, pelvic contraction is unlikely; if she gives a history of difficult

FIG. 92.—SIMPLE FLAT PELVIS.

(Royal College of Surgeons' Museum, No. 555.)

This is described as "elliptical and non-rachitic." The following measurements are given:—

Intercristal	11 inches.
Interspinous	10¼ "
External conjugate	6½ "
Subpubic angle	90 degrees.

Brim—Diagonal conjugate, 4 ins. True conjugate, 3½ ins. Oblique, 5¼ ins. Transverse, 5¾ ins.

Outlet—Antero-posterior, 4½ ins. Transverse, 5⅜ ins.

The following description is given:—

"A pelvis of average size showing eversion of the ilia, diminution of the true conjugate and widening of the transverse diameter of the brim and of the pubic arch. The transverse sacral curve is somewhat flattened, whilst the vertical curve is normal. The individual bones are not diminished in size. It is possible, however, that the deformity was due to rachitis (rickets) which developed in early life and was speedily arrested. The fourth and fifth lumbar vertebræ and the lumbo-sacral and sacro-sciatic ligaments are preserved."

By comparing this with the preceding figure, the flattening of the brim will be obvious.

FIG. 93.—SMALL FLAT PELVIS.

(Royal College of Surgeons' Museum, No. 558.)

This is described as a "dwarf rachitic pelvis," and the following measurements are given:—

Intercristal	9⅛ inches.
Interspinous	9½ "
External conjugate	5½ "
Subpubic angle	95 degrees.

Brim—Diagonal conjugate 2⅜ inches. True conjugate 2⅛ " Oblique 4½ " Transverse 4⅜ "

Outlet—Antero-posterior 3⅜ " Transverse 4⅜ "

This pelvis is drawn to the same scale as that in Fig. 86, so as to show the general diminution in size of the bones. The promontory is sunk forward into the brim, thus giving the inlet a kidney shape. The interspinous diameter is wider than the intercristal by one-eighth of an inch. The pubic arch is widened.

instrumental labours, stillborn babies, and so forth, the probability is that some degree of pelvic contraction is present. With this history she should be advised in accordance with E (1), C.M.B. Rules: "Whenever the previous pregnancy has ended in an abortion, a premature labour, or a stillbirth, the midwife on being engaged to attend the patient in her next confinement, shall explain that the case is one in which skilled medical advice is required, and shall urge the patient to seek advice from her medical attendant, or at a hospital or other suitable institution."

In the case of a primigravida, where no history of previous labour is available, the only matters to be inquired into are whether she or her mother know of her having had rickets, how old she was when she began to walk, and whether she has any bowing of the legs, spinal curvature, or deformity that might suggest pelvic contraction. Sometimes a history of incarceration of the pregnant uterus in the pelvis during the fourth month giving rise to retention of urine may be obtained.

This is most likely to occur in cases of flattening of the pelvis owing to the projection of the sacrum preventing the developing uterus from rising into the abdomen, but often occurs in multiparæ with a lax pelvic floor in whom the uterus lies low in the pelvis and displaced backwards (retroverted) (p. 87).

Appearance.—The general build of the patient should be noted; if she is small in stature, stunted, or dwarfed, lame, bow-legged, or humpbacked. If she is under 5 feet in height a very careful examination should follow, as the pelvis will probably be below the normal size, and she should be referred to a doctor. Her limbs should be examined for signs of rickets, bowing of the shins and thighs, knock-knee, thick wrists, pigeon-breast, and curved spine. Rickety patients generally have jaws of the "nutcracker" type with bad teeth, and the skull bones may be large and bossy. Pelvic deformity may be associated with hip disease, spine disease, and lameness generally, especially if in childhood she was kept on her back for long periods.

Abdominal Examination.—In a primigravida, marked prominence of the uterus in the later months of pregnancy should suggest to the midwife the possibility of pelvic contraction. In primigravidæ the head generally sinks down into the pelvis some weeks before term, but if, owing to contraction at the brim, it is kept up in the abdomen the uterus looks larger and is more prominent than usual. For the same reason, on palpation the head can be felt floating freely above the brim. If this is found to be the case in the last month of a first pregnancy, the patient should certainly be referred to a doctor. In multiparæ with slack abdominal walls, it is quite usual for the head to be freely movable above the pelvic brim, and hence this is not of the same importance, but the history of the previous labours will decide whether it is necessary to seek medical advice. If the head is felt movable above the brim, an effort should be made to see if it will enter the pelvis. It should be held between the fingers and thumb of one hand and pressed down into the brim (Fig. 67, p. 129); if it sinks down readily, there is no obstruction. It must be remembered that malpresentations are common with contraction of the pelvis.

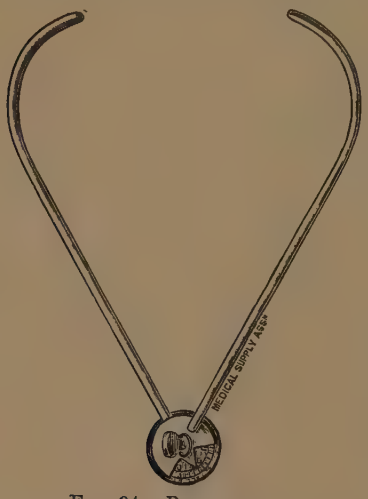

FIG. 94.—PELVIMETER.

This simple form of callipers has been designed for use by midwives. The points are placed over the spines or crests as the case may be, and the distance read off on the dial at the junction of the two arms.

Vaginal examination in a primigravida ought to show the head in the pelvic cavity during the last two weeks of pregnancy; if it is above the brim and movable, the cause is probably contraction of the pelvis. If the promontory of the sacrum can be easily reached, this will confirm the diagnosis. When the presenting part is high up or cannot be made out in a woman in labour at or near term, send for medical aid (C.M.B.).

Measurements.—The pelvic measurements which are of use in deciding whether the pelvis is of normal size or not have already been described on page 38. The external measurements are not reliable and require the use of special callipers. A simple pattern of callipers for the use of midwives is sold by the instrument makers, and the measurements when made should be noted on the antenatal form, in accordance with Rule E 1 (C.M.B.).

The important points in regard to these measurements may be repeated. The interspinous is normally about 10 inches, the intercristal about 11 inches. The intercristal is roughly twice the transverse diameter at the brim (5 to 5½ inches). If they are much below this, *e.g.* 8 and 9 inches, but preserve their normal relation of 10 to 11, *i.e.* about an inch difference, the pelvis is probably a generally contracted one. If the interspinous is relatively wide to the intercristal, and especially if it is equal, or, still more, if it is greater, *i.e.* the difference is much less than it should be, the pelvis is probably rickety and flattened. The cause of this has been explained above.

The external conjugate taken from back to front gives a very rough idea of the true conjugate; it is generally about $7\frac{1}{2}$ to 8 inches, and 3 to $3\frac{1}{2}$ inches must be subtracted to get the true conjugate. In a fat subject the measurement is of no value.

The really important measurement is the diagonal conjugate, and an effort ought to be made to reach the promontory in all primigravidæ, and when it can be reached, to measure this diameter as described on page 38.

The distance between the ischial tuberosities, giving the transverse diameter at the outlet, can be measured with callipers or a tape measure, and is occasionally of importance.

The child's head itself gives the most useful estimate of its relation to the size of the pelvis. If the head can easily be pressed into the brim by the hand, the uterus will evidently have no difficulty in doing the same. A good plan is to do this as described for the abdominal examination, while the first two fingers of the other hand

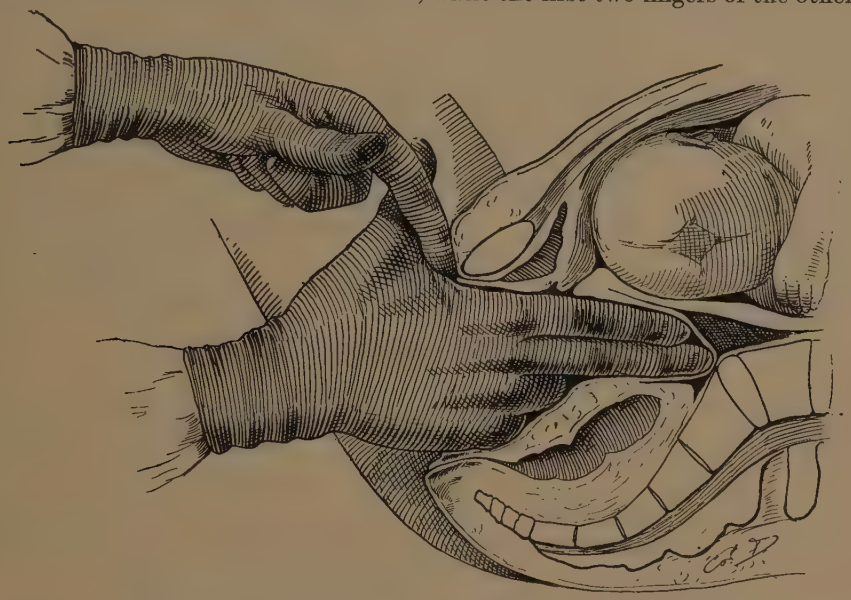

FIG. 95.—THE MEASUREMENT OF THE DIAGONAL CONJUGATE.

The index and middle fingers are passed into the vagina and pressed upwards till the middle finger touches the sacral promontory. Care must be taken that the true promontory is the actual point touched. The point on the edge of the hand just under the symphysis is then accurately marked by the index finger of the other hand, and the fingers removed from the vagina. The finger is kept on the spot on the border of the hand marked as just under the symphysis, and the distance from there to the tip of the middle finger measured by callipers or a tape measure. The true conjugate is less than this measurement by rather over half an inch.

in the vagina estimate how much room there is between the head and the pelvic walls, and how far the head can be made to slide down behind the symphysis.

III. THE COURSE OF LABOUR IN CONTRACTED PELVIS.

If the midwife sees the patient for the first time when she is in labour, and discovers that the head is movable above the brim in a primipara or that there is a history of previous difficult labours, she ought to summon the doctor at once, as many complications may arise which will make treatment difficult.

In the first stage there may be a finger-shaped bag of membranes which will rupture early, and the cord may prolapse, and the liquor amnii drain away. The delay will be chiefly after the membranes have ruptured, and if there is uterine inertia, instrumental or other assistance may be required. In a flat pelvis the long diameter of the head enters in the widest diameter—the transverse—and with some degree of extension, and hence persistent occipito-posterior positions, and brow and face presentations may occur. In a generally contracted pelvis, the ordinary

mechanism is exaggerated, and extreme flexion its most easily distinguished feature. Though in many cases labour proceeds normally even with the pelvic contraction, the risks to mother and child are increased. To the mother there is the exhaustion of a prolonged labour and the possibility of postpartum hæmorrhage from uterine exhaustion ; there is an increased risk of sepsis from the prolongation of labour and the greater internal manipulations that may be necessary ; there is also the risk of obstructed labour with the possibility of sloughing from pressure, tonic contraction, and rupture of the uterus. The child also runs greater dangers from the frequency of malpresentation, of prolapse of the cord, injury from pressure after the escape of the liquor amnii, and asphyxia from interference with placental circulation.

Prolapse of the Cord.

Sometimes a loop of cord comes down in front of the presenting part and is then liable to be compressed between it and the pelvic wall, and so causes death of the fœtus. Descent of the cord is, therefore, a very serious complication so far as the child is concerned (nearly half the children are stillborn), but in itself does not add to the gravity of the case so far as the mother is concerned. It occurs chiefly in cases in which there is some malpresentation or flattening of the pelvis, which allows room for the cord to descend owing to the lower uterine segment and pelvic brim not being completely filled up by the presenting part. Thus all cases in which the cord comes down must be looked on as possibly serious for the mother also, because of some abnormal condition which has predisposed to the prolapse. There are two varieties of descent of the cord.

1. **Presentation,** in which the cord is felt through the unruptured membranes below the presenting part.

2. **Prolapse,** in which the cord has come down into the vagina in front of the presenting part after rupture of the membranes.

The chief causes of this complication are : tumours in the pelvis ; pendulous abdomen with marked obliquity of the uterus and late engagement of the head ; small and premature fœtuses, owing to their occupying less space and thus leaving room for a loop of cord to descend ; malpresentation, especially transverse lies and breech presentations, and contracted pelvis of the flattened type. Other causes are : placenta prævia, because the cord is nearer the os than usual ; with a very long cord there is more tendency to prolapse ; excess of liquor amnii allowing of great mobility of the fœtus and causing late engagement of the presenting part, and especially if there is a great rush of water on rupture of the membranes by which the cord may be carried down.

Treatment.—Descent of the cord is not an instance given in the C.M.B. Rules as one for which medical help must be obtained, but it is covered by the instruction that such help must be sent for in case of " any abnormality occurring during pregnancy, labour, or lying-in " (E 20).

The midwife will, therefore, at once summon assistance, and while waiting will do what she can to prevent the cord being compressed if the child is alive. The first thing is, therefore, to decide whether the cord is pulsating. A loop should be held between the index and middle fingers, great care being taken not to rupture the membranes if the case is one of presentation, and if pulsations are felt the child is obviously alive ; if the pulsations are slow or feeble, its condition is urgent ; if the pulsations are strong and quick, the outlook is much better. If the cord is pulseless, there is no chance of saving the child, and no attempt should be made to carry out any special treatment. If the child is alive, the treatment will depend on whether it is a case of presentation or prolapse of the cord. In the former the risk of compression is very much less because of the presence of the liquor amnii, and therefore nothing must be done which might provoke rupture of the membranes and convert presentation into prolapse. No more examinations and no attempt at replacing the cord should be made. The only thing to be done is to place the patient in such a position that the fundus uteri is at a lower level than the cervix, in the hope that gravity will cause the loop of cord to sink towards the fundus. The best position for this is the knee-chest (genupectoral). The patient kneels on the

bed with the hips directly above the knees and the chest and shoulders on the bed, with the face on a pillow and turned to one side for easier breathing (Fig. 96). This makes the os the highest and the fundus the lowest part of the uterus ; the presenting part slips away from the brim, and thus the chances of pressure on the cord are lessened and possibly the cord itself will return into the uterine cavity. Unfortunately the position is so constrained that the patient will not remain in it for more than ten or fifteen minutes. The knee-elbow position may be tried for a little longer as being somewhat less uncomfortable—that is, the patient will raise her shoulders and rest the upper part of the body on the elbows. When she can continue no longer, let her turn gently over on to her side, or, if need be, resume the knee-chest position at intervals. If the membranes rupture, the case must be treated as one of prolapse.

In prolapse of the cord, if the pulsation is good and the doctor will arrive shortly,

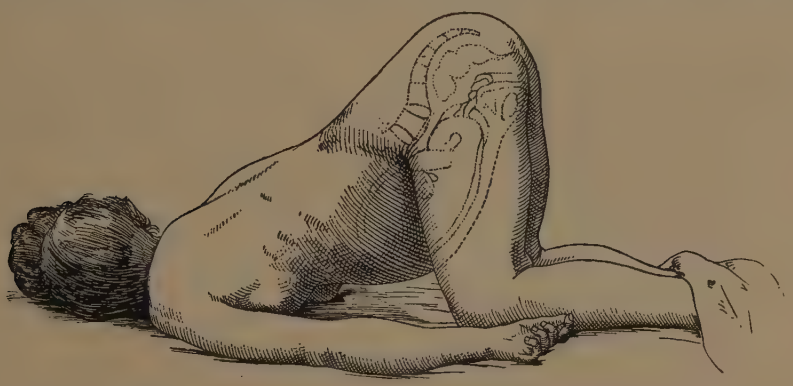

Fig. 96.—Postural Treatment for Presentation of the Cord. The Knee-Chest Position.

The cord is seen in the vagina below the child's head. In this position the fundus is the lowest part of the uterus. The presenting part will tend to drop away from the brim and the cord to sink towards the fundus.

all that should be done is to try postural treatment as above, but not so much in hope of the cord going back, as it may when the bag is intact, but to lessen the pressure of the head on it.

If labour is going on rapidly, push the cord to the side of the pelvis about opposite the sacro-iliac joint. There is more room at the side of the sacral promontory and it has the best chance of escaping pressure there.

If the doctor will be long in arriving, and the pulsations are becoming slow, showing that the infant is in danger, an attempt may be made to replace the cord with the fingers. This is not easy ; it is most likely to be successful if carried out with the patient in the knee-chest position. The cord is caught between two fingers and an attempt made to carry it above the presenting part to one or other side of the promontory. In multiparæ with a relaxed outlet which will admit the hand, this can often be done ; in primiparæ, it will probably fail. Success is most likely to be attained if the loop of cord is first wrapped in sterile gauze and made into a bunch that can be most easily pushed above the head. The gauze and cord are then left and the head pushed into the brim, and a firm binder put on to keep it engaged. Should the midwife have a gum elastic catheter, a hole should be made opposite the eye of the catheter and a loop of tape passed through and both sterilized ; a loop of cord is snared in the loop of tape, and the tape drawn just tight enough to hold the cord but not compress it. This must be tested by feeling the pulsation in the loop of cord below the tape. The catheter carrying the loop of cord is now passed up into the uterus above the presenting part and left there. A tight binder is then put on to fix the presenting part in the brim.

CHAPTER XX.

ANTEPARTUM AND POSTPARTUM HÆMORRHAGE.

During pregnancy and labour, bleeding may occur from the interior of the uterus or from the cervix and lower genital tract. The former almost alone will be considered here, but the pupil's attention may be drawn to the latter, so that it is not overlooked as a possible source of hæmorrhage.

Bleeding from the cervix may be due to laceration in labour (p. 222) or cancerous growth (p. 331); bleeding from the vagina and perineum, to injury and laceration during labour; and bleeding from the vulva, to ulceration, rupture of varicose veins or injury.

Apart from the rare and doubtful cases of menstruation in the early months already mentioned on page 70, hæmorrhage from the uterus during pregnancy is always due to the tearing through of the attachments of the ovum to the uterine wall. At first it may occur as the result of the separation of any part of the ovum, but as the placenta develops and becomes differentiated so as to form the sole means by which the ovum is brought into connection with the maternal blood, it will be less and less from detachment of the membranes and occur more and more as the result of separation of the placenta. With the growth of the ovum and the increasing distension of the amniotic sac by the fœtus and liquor amnii, the chorion and decidua over the non-placental surface of the sac become squeezed out into a thin and nearly bloodless membrane, so that by full time its detachment from the uterine wall causes no more hæmorrhage than is seen in the slight "show" that occurs at the commencement of labour from its separation round the os as the lower uterine segment stretches. This may be roughly summed up by stating that in the first half of pregnancy hæmorrhage will occur as the result of the detachment of any part of the ovum from its uterine bed, and that in the second half it will be the result of the separation of the placenta. The point of this distinction is that separation of the ovum is the first step towards its complete detachment and expulsion, and thus towards the termination of the pregnancy. In the first half of pregnancy, then, the first sign of its possible termination, *i.e.* of "abortion," is hæmorrhage, but in the second half, and more especially as the conditions present at term are approached, the onset of labour will be more like the normal, and the occurrence of pains and a slight show will be the warning signs. If there is hæmorrhage of any moment, a more serious complication will be present, namely, premature separation of the placenta (antepartum hæmorrhage).

Bleeding during pregnancy, therefore, falls into one of two categories—abortion or antepartum hæmorrhage, and bleeding during labour into antepartum or postpartum hæmorrhage according to the time of its occurrence—before or after the birth of the child. Abortion has been considered in Chap. VIII., page 87, and hence there remains only ante- and postpartum hæmorrhage.

A.

ANTEPARTUM HÆMORRHAGE.

Under this heading is included uterine hæmorrhage from the time the child is viable, up to its birth, that is, from the twenty-eighth week of pregnancy to the end of the second stage of labour. But it must not be thought that any hard-and-fast line can be drawn at the twenty-eighth week of pregnancy; cases occurring

shortly before this time will be exactly the same as those after it, but it is a great convenience to discuss this complication as connected with labour, premature or full time, and as the majority of cases occur near term, there is little objection.

Antepartum hæmorrhage is due to the placenta becoming separated from its attachment to the uterus before the proper time—the third stage of labour ; owing to the child being still *in utero*, retraction, which is nature's method of controlling the bleeding from the placental site, is absent till active labour begins and is incomplete till the uterus is empty.

Varieties.

Two conditions are distinguished in which the placenta separates before the birth of the child—(1) Separation of the placenta when abnormally situated—in whole or in part—on the lower expansile segment of the uterus, called placenta prævia or unavoidable hæmorrhage. (2) Separation of the placenta when normally situated on the upper contractile segment of the uterus, called retro-placental or accidental hæmorrhage.

These two varieties must now be considered in detail.

1. **Placenta prævia** or **Unavoidable Hæmorrhage.** — The placenta is " prævia " or before the child when any part of it is situated on the lower uterine segment (p. 98). As a consequence of this, when the lower segment stretches during dilatation at the end of pregnancy and in the first stage of labour, the placenta attached to it *must* become separated and bleeding will occur, and thus this variety of antepartum hæmorrhage is also called *unavoidable*. We know little of the reasons for this abnormality of the placenta. Evidently the ovum in entering the uterus has not as usual sunk into the decidua in the upper part, but has dropped down towards the internal os and become embedded low down. The decidua basalis will then be in the lower segment and the placenta will form there. Or it may be that the chorionic villi grow partly into the decidua capsularis—because the ventral stalk of the early ovum is directed that way—so that as the ovum comes to fill the cavity it becomes blended with the decidua of the lower uterine segment and there forms the placental attachment. But no reason can be given either for a low basal placenta or for a capsular placenta, and so these explanations do not carry us far. The important facts for the pupil to keep in mind are, that a low placental insertion is not infrequent, and that if it is low enough to encroach on the expansile segment of the uterus, bleeding will occur when that segment stretches and tears through the placental attachments. It

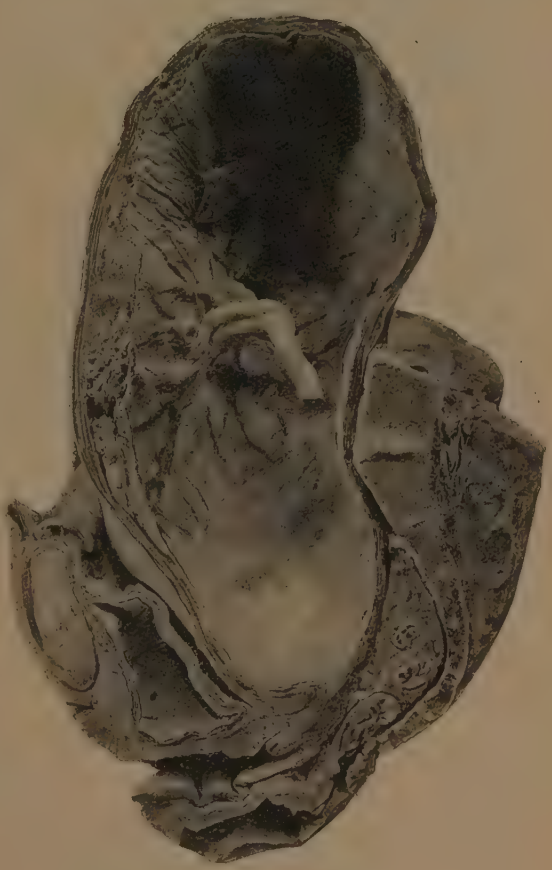

Fig. 97.—A Normally Situated Placenta.

A section showing the right half of the uterus with the placenta situated in the upper active contractile segment of the uterus. Compare with the abnormal situation of the placenta in the next three figures.

is more common in multiparæ than in primigravidæ, and this suggests that a damaged uterus or unhealthy mucosa may be a factor in its causation.

There are several degrees of this condition. The placenta may cover the internal os—complete or central placenta prævia, or the margin of the placenta may overlap the os—marginal placenta prævia, or the placenta may not come so far as the os, but only extend on to the lower uterine segment—lateral placenta prævia.[1] These distinctions are not important, and indeed are so rough as to be very inaccurate. For instance, when the os can just admit the finger, the placenta may completely cover it and the case be looked upon as central. By the time the os is large enough to admit two fingers, the placenta may be felt to cover half the os and the membranes the other half, so that it may be termed marginal, as the edge of the placenta then overlaps the os. Again, when the os admits one finger, membranes only may be felt and the case diagnosed as separation of the placenta, its position being uncertain. When the os is more fully dilated the edge of the placenta may be felt, showing it is a case of placenta prævia, marginal or lateral. For ordinary clinical purposes these degrees are useful as an expression of the severity of the case. If nothing but placenta can be felt through the os, the case is considered as central, and it is recognized as the most serious variety, because so much more of the placenta must be separated before there is sufficent dilatation for the child to pass; if either early or late in the labour the edge of the placenta is felt, the case is described as marginal. The lateral cases are those in which it is recognized, by examination of the sac after expulsion, that the placenta was inserted partly on the lower segment, though it may have been impossible to touch the placenta by vaginal examination.

Fig. 98.—Central Placenta Prævia.

The internal os is completely covered by the placenta, which is attached to the surrounding uterine wall. Nothing but placental tissue would be recognized till full dilatation, when it might be possible for the finger to reach the membranes in front of the os. Extensive separation and therefore severe hæmorrhage will occur before complete dilatation.

Labour with placenta prævia is often premature, and indeed many cases of abortion are possibly due to this condition. Malpresentation is not uncommon, because the placenta fills up the lower uterine segment and so may displace the presenting part. The contractions are often poor because the placenta interferes with dilatation and with the descent of the presenting part into the cervix to stimulate uterine action. The placenta itself is generally thin and spread out over a wider area than usual and succenturiate portions are not uncommon. Hæmorrhage often occurs during pregnancy, because,

[1] There is some confusion in regard to the application of the two latter terms. Some teachers apply lateral to the cases where the placenta overlaps the os, and marginal to those where it extends on to the lower segment but does not reach the os. The term partial placenta prævia is also sometimes used where the placenta partly covers the os.

with a low insertion and an expanded placenta, separation easily occurs from slight shocks or accidents. It may occur as early as the fourth month, when the case will come under abortion, but the most serious bleeding occurs with the onset of labour at or near term when the commencing dilatation causes separation. In this variety of antepartum hæmorrhage it is not usual to get much in the way of concealed bleeding—the placenta being near the os the blood readily finds its way out. Hence it is generally brighter in colour than in accidental hæmorrhage, where it may have been retained some time.

Placenta prævia is always a serious complication. In the minor degrees when the uterus is acting well, both mother and child are generally saved. When the placental insertion is central or nearly central and the uterine action is feeble, the danger is considerable. To the mother there is the risk of death from loss of blood and operative interference, and to the child from extensive interference with the placental circulation from detachment and pressure on the placental site throughout the later part of the delivery. Besides the immediate risk to the mother there is the increased chance of sepsis from the internal manipulation, the lower and therefore more easily infected placental site, and the lowered resistance to infection owing to loss of blood, and of thrombosis, embolism, and other complications in the puerperium.

Fig. 99.—Partial or Marginal Placenta Prævia.

The edge of the placenta is over the internal os. When there is sufficient dilatation to admit one finger, the margin of the placenta will be felt in front and the membranes behind. As dilatation progresses, the placenta will be felt partially covering the os.

Treatment.—The chief principles underlying the medical treatment of placenta prævia are (1) to obtain compression of the placental site either by rupturing the membranes and bringing the head down on to it, performing version and plugging it with a half breech or putting in a dilating bag; (2) to extract slowly to avoid collapse of the patient and postpartum hæmorrhage, and (3) encourage uterine action to effect expulsion gradually and control the bleeding afterwards.

Midwives in the colonial nursing service and other services abroad may find themselves faced with very severe cases of antepartum bleeding and no possibility of medical assistance for many hours, and the question arises whether, in the event of the failure of the preceding methods, version and bringing down a leg ought to be attempted. The difficulty in deciding this point arises from the fact that as the dangerous time is during dilatation the necessity for this operation is at a time when the os is small; when once the os is nearly fully dilated the most dangerous time has passed. Also, the lower uterine segment is easily lacerated and any tear is particularly serious because of the increased blood supply, owing to the low situation of the placenta. Therefore a midwife without special training in doing such an operation might put her patient to greater risk in attempting it than if she left the woman to take her chance of dying from hæmorrhage. If the breech presents, let her bring down one leg and pull on the foot when bleeding occurs. That can be done without much danger. Also, if she can turn the child by external manipulation so

as to make the breech present and then rupture the membranes and bring down a leg, well and good. If the os is sufficiently dilated to allow the hand to be worked through it into the uterus so as to seize a foot, this may be attempted in serious emergencies. While maintaining traction on the foot the head should be pushed up to the fundus by a hand on the abdomen till the turning is complete. The half breech is a very good plug, and by dragging on the foot can be made to press firmly on the placenta, and once this is done the control of the bleeding is usually easily effected (see account of internal version, page 311). But, unless she has been specially trained for such emergency work in out-of-the-way districts, it may be better to rely upon plugging the vagina.

The Dublin method of vaginal plugging and counter-pressure with an abdominal binder is more suitable for accidental hæmorrhage, but may also be adopted for placenta prævia. It is useless unless done thoroughly, and to do it thoroughly without anæsthesia is far from easy. The plugging chiefly acts by stimulating the uterus to contract, and unless done tightly it will have no effect. A large amount of material will therefore be required. It is unlikely that the midwife will have sufficient gauze or wool for the purpose. However, any sterilizable material will be an efficient substitute. Handkerchiefs, linen sheeting, or towels torn into big strips will do; a resourceful midwife has been known to sacrifice most of the baby's clothes for this purpose. The material must be boiled for ten minutes to render it aseptic; a poisonous antiseptic must never be used. The vulva must be thoroughly cleansed and the bladder emptied by catheter. The utmost care must be taken not only to render the material used sterile but also to avoid its being soiled during introduction. The danger of infection is such that some authorities have doubted the value of this mode of treatment and examiners have even threatened to reject candidates who have mentioned it as an emergency measure. That it is supported by good results and advocated by the eminent school in Dublin is a sufficient answer to those who would prohibit its adoption by the midwife unable to obtain early assistance.

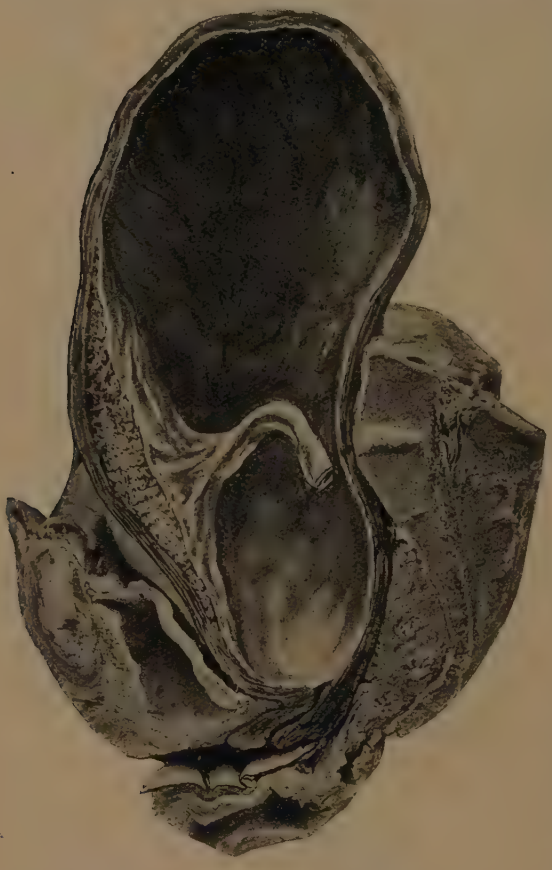

Fig. 100.—Lateral Placenta Prævia.

The lower portion of the placenta extends on to the lower uterine segment but does not reach the os. When the os will admit one finger membranes only will be felt, but possibly when fully dilated the lower edge of the placenta may be reached, or the low insertion of the placenta may only be discovered by examination of the sac after expulsion. This variety of placenta prævia may give rise to very little bleeding and may not be distinguishable during labour from accidental hæmorrhage.

With the patient on her left side on the edge of the bed and the gauze or linen strips wrung dry in a bowl by her side, the midwife sits by the side of the patient, and with two fingers of the left hand passed into the vagina so that their tips are behind the cervix, proceeds to pack the vagina. If possible, a strip should be inserted into the cervix; then the posterior fornix is firmly plugged, then the left and right fornices, and then the anterior; these plugs are pressed tightly upwards by the fingers of the left hand in the vagina, and a fresh lot pushed in below them to keep them pressed up, and again another, till the vagina is as tightly filled as it will hold and is sufficiently distended to make the vulva gape slightly. A thick pad is then placed over the vulva and the patient turned on to her back. A tight binder, with a band to come through between the legs, is now put on and pinned as tightly as possible above, over the fundus uteri. The band is brought through between the legs over the vulval pad and pinned tightly on to the binder in front. By this means the vagina is distended (as by the child's head in the second stage of labour), thus exciting uterine activity, and the uterus is compressed between the tight binder and the plugs. When the whole operation is completed, give the patient a strong sedative draught, or an opium pill, and some hot milk; keep her quiet, and if she sleeps, uterine contractions will follow in a short time. The head will come down and press on the plugs and they will begin to bulge the

perineum. Take them out as the head comes down, and, in any case, do not leave them in over twelve hours, as they may do harm.

2. **Accidental Hæmorrhage, Ablation of the Placenta.** — Why the placenta should separate when situated in the upper uterine segment is not known. It does so most frequently in stout, flabby multiparæ, especially if they have had many children in quick succession, and seems from this and from the behaviour of the uterus, which is feeble and flabby and acts badly, to be associated with some disease or defect of the uterine muscle. It is also liable to occur in women with grave constitutional disease, such as chronic kidney disease and certain blood diseases. The view that ablation of the placenta may be a manifestation of the toxæmia of pregnancy is widely held, and there is much evidence in support of it. Albuminuria is present in many cases of accidental hæmorrhage. Possibly disease of the placenta or decidua may be a factor by weakening the placental attachments to the uterus. In the majority of cases the bleeding occurs without any obvious cause, often when

FIG. 101.—THE VAGINA PLUGGED FOR ANTEPARTUM HÆMORRHAGE.

Plugs of cotton-wool have been used and packed so tightly into the vagina that they dovetail closely into one another and form a compact mass. The vaginal fornices are seen to be pushed up out of the pelvis so that the anterior one could be felt on abdominal examination. Combined with an abdominal binder and T-bandage, the pressure on the uterine arteries and the stimulus to uterine action will be evident.

the patient is at rest in bed. Sometimes a trifling fall or blow, such as would have no effect on a healthy uterus and placenta, may be the immediate cause. On the other hand, a severe injury, such as a violent blow on the abdomen or a heavy fall, may result in the detachment of the placenta in a strong healthy woman with a healthy uterus. These traumatic cases with a definite provoking cause are rare but more favourable, because the healthy uterine muscle is better able to cope with the condition and check the bleeding.

Where the placenta is detached from the uterine wall, bleeding will occur from the opened sinuses. Generally the effused blood strips off the membranes and makes its way to the cervix and vagina and appears externally. Also, partly by acting as a foreign body and partly as a consequence of its stripping up the membranes, it may start labour pains, which will further help in its expulsion. But there will always be some blood behind the separated portion of the placenta and between the membranes and the uterine wall which will clot and will

not escape from the uterus till the expulsion of the placenta and membranes. If the placenta happens to be high up in the fundus, or if the detached portion is the upper edge of the placenta, it will take longer and be more difficult for the blood to escape ; or if the membranes are firmly adherent in the lower pole of the uterus, or the presenting part is pressed firmly down into the lower uterine segment so as to act as a plug, the escape of the blood will be made more difficult. In such cases the blood will be retained, wholly or in part, in the uterus. But the factor which seems of the greatest moment in determining the amount of blood retained in the uterus is the state of the uterine muscle itself. With a strong and active uterus contractions will be set up by the blood retained in the uterus, will produce dilatation of the os and squeezing out of the retained blood, and also help to check further bleeding. On the other hand, a weak and flabby uterus does not react to the stimulus and allows itself to become distended with the effused blood, and the more it is distended the less able is it to contract. These cases are the most serious because we have to deal with an inert and inefficient uterus. When no blood escapes, the condition is termed *concealed accidental hæmorrhage*, and happily it is rare. In the more usual form, part at least of the blood escapes externally, though it is not possible to tell exactly how much may be retained within the uterus. In the vast majority of cases of accidental hæmorrhage with visible bleeding a quantity of dark clot escapes after the birth of the child or with the placenta. The pupil must therefore bear in mind that a patient may bleed to death from antepartum hæmorrhage without a drop appearing externally, or she may be losing a trifling amount, judging by what is seen, and yet bleed to death, because a far greater quantity of blood is lost to the circulation but remains concealed in the uterus. The lesson of this is, that the seriousness of a case must not be estimated by the amount of blood escaping at the vagina, but by the patient's pulse and general condition, and that the signs of serious hæmorrhage should be carefully looked for, as they may be present even in the absence of visible bleeding. The signs of hæmorrhage are—the patient feels faint, sick, or giddy ; she often says she feels as if she were sinking through the bed. She is very pale, and the pallor is best seen in the lips and in the conjunctiva, *i.e.* by looking at the red inside of the lower eyelid ; the surface of the body is cold and sometimes bathed in cold sweat ; there is great air hunger, the patient gasping for breath and, when the condition is serious, throwing her arms

FIG. 102.—ACCIDENTAL HÆMORRHAGE WITH EVIDENT BLEEDING.

The section has been made through the middle of the uterus and shows almost complete detachment of a normally situated placenta with great effusion of blood. The blood has stripped off the membranes down to the os and is escaping externally. The part of the placenta deep to the line of section, *i.e.* the portion on the left half of the uterus, remains attached to the uterine wall.

about. The pulse is rapid, small, and feeble, so that at last it becomes running and uncountable. Unconsciousness supervenes before death. The more rapidly the blood is lost the more serious are the symptoms.

It is usual to divide accidental hæmorrhage into two varieties—the concealed and the evident; the candidates at the C.M.B. examinations seem to prefer the term "revealed" for the latter, either because it sounds better and has a scriptural flavour or because it rhymes with the other. Perhaps the commonest type of all is one that may be termed "mixed" in which blood is partly retained but for the most part escapes.

Fig. 103.—Concealed Accidental Hæmorrhage.

The section shows the left half of the uterus and its contents with a concealed accidental hæmorrhage. The placenta, situated partly on the fundus, is shown completely detached, though areas of attachment may be present to the right or left of the middle line through which the section is made. The blood has stripped off the membranes as far as the fœtal head and is seen bulging them in towards the amniotic cavity. A boss formed by a projecting mass of blood may be noticed just below the child's hand. No blood is escaping externally. The distension by the effused blood and the more globular shape of the uterus as compared with Fig. 96 are well seen.

Diagnosis.—It is not necessary for the midwife to recognize one variety of antepartum hæmorrhage from the other. Her duty in any case of bleeding during pregnancy or labour is to obtain medical assistance at the earliest possible moment and meantime apply such first-aid as may be required. It is inadvisable to make any internal examination, because of the increased danger of sepsis that arises in all cases of hæmorrhage. The patient's resistance to infection is greatly lowered by loss of blood. In placenta prævia especially, because the placental site is low down and internal manipulation often required, every vaginal examination is an added risk. The following points are those which guide the doctor in making the distinction, and those of them not entailing examination per vaginam are available for the midwife.

The bleeding from placenta prævia usually occurs earlier in pregnancy and is repeated; frequent slight bleedings are often warnings of a low placental site. The hæmorrhage is also sudden in onset, without apparent reason, painless, and in the form of bright blood coming in gushes with clots. The presenting part is usually high and not engaged and malpresentation is common. A thick boggy substance may be felt per vaginam between the finger and the presenting part, but a certain diagnosis can only be made when the os admits a finger and some portion of the placenta is recognized.

Accidental hæmorrhage is often complicated by albuminuria and other symptoms of pregnancy toxæmia, and the bleeding often accompanied by pain owing to blood being retained in the uterus. With retained clot there is more serum squeezed out so that the loss is more watery and less clotted than in placenta prævia, and later may become brownish. The uterus may be tense and tender, in parts or all over, if

there is much concealed blood. The presenting part is usually fixed and the fœtal heart sounds less likely to be heard or fœtal movements felt.

The rate and character of the patient's pulse, the respiration rate, and her general appearance should be noted, a careful abdominal examination being made to see if there is any evidence of concealed bleeding. When there is concealed hæmorrhage, the patient complains of severe pain of a stretching or tearing character, due to the distension of the uterus. On abdominal examination the uterus is found to be tender and tense, and more globular than usual. The tenseness of the uterus prevents the fingers from feeling the fœtal parts and fœtal movements, and, as the fœtus soon dies from the extensive separation of the placenta, no fœtal heart will be heard. The severe abdominal pain, added to the effect of the internal hæmorrhage, brings about a state of serious collapse. The patient is restless and blanched, and her extremities cold, the pulse rapid and feeble ; the respirations rapid, deep, and sighing. The marked signs of blood pent up in the uterus will only be found in cases in which there is little or no external bleeding, but the general signs will develop in any case of severe and continuous bleeding, whether external or internal. Some cases of concealed hæmorrhage come on with extreme suddenness, faintness and collapse occurring in a moment.

Treatment.—*Preventive.*—Because the causes of antepartum hæmorrhage are not sufficiently clear, prevention is not really possible, but much can be done by immediate treatment of all cases in which slight bleeding gives a warning of possible dangers to come. By all albuminuric cases being kept under observation and treatment the danger of severe accidental hæmorrhage may be lessened.

Emergency measures.—In accordance with the regulations of the C.M.B. medical assistance must be summoned " in the case of a pregnant woman, when there is loss of blood," and " in the case of a woman in labour at or near term, when there is excessive bleeding." In London, or any large town where there is always a red lamp somewhere round the corner, nothing need be done except to keep the patient quiet in bed, watch her carefully, and await the arrival of the doctor. The midwife cannot go wrong by applying a firm abdominal binder to encourage uterine action.

If the bleeding is slight and the patient not near term the doctor may decide not to interfere, but to have the patient kept under close observation. The bleeding may cease and not recur and the woman go her full time. The midwife might then have to watch the patient for the doctor, and see that she was kept at rest and that his other instructions were carried out, and report at once any further loss of blood or other unfavourable symptom.

If the bleeding is severe, the patient is in danger till the uterus is empty and fully retracted and the uterine vessels compressed. Hence it may be said that with good uterine action the case is a favourable one, with feeble action the case is a dangerous one.

The difficult problem is, what the midwife ought to do with severe bleeding and a poorly acting uterus and a long delay before medical aid can reach her. In an emergency of this kind she must follow the course of treatment now described, as soon as she is satisfied that the patient is in danger if further time is lost.

If labour has not commenced, a sedative draught—for instance, 15 to 20 drops of laudanum—may be given ; it will keep the patient quiet, physically and mentally, and so produce the best conditions for arrest of bleeding. If the woman is in labour and has had previous easy labours and the child is not lying transversely, a dose of ergot may be given and a firm binder put on, or the uterus massaged through the abdomen. An antiseptic vaginal douche at 115°, or as hot as the patient can bear, should be given to stimulate uterine action.

The next procedure is *to rupture the membranes*, and in regard to this some remarks must be made. It should not be done unless in the midwife's opinion the risk is such that it is dangerous to wait longer for the doctor. He may wish to turn the fœtus, and turning is more difficult after rupture of the membranes. The most suitable case for this treatment is when the patient is having pains and the cervix is dilated. The fœtus must be lying longitudinally ; it should never be done in a transverse lie, as the doctor will have to turn the child. In premature labour, rup-

ture of the membranes is least open to objection. The effect of allowing the waters to escape is to cause retraction and to stimulate the uterus to stronger contraction or to force the presenting part down on to the placental site, compress it and so check bleeding from a low implantation.

The midwife should also keep a careful watch on the patient's general condition. Stimulants should not be given unless the patient shows evident signs of failing circulation—they stimulate the heart to increased action and thus tend to aggravate the hæmorrhage ; so long as the pulse is not failing, their administration is best postponed. Hot drinks and saline *per rectum* should be given, and the treatment applied for collapse after excessive bleeding, as described below.

There are some special points about the concealed variety of accidental hæmorrhage which deserve mention. In this very serious condition the lack of tone in the uterine muscle is such that the uterus becomes stretched and distended by the effused blood, and treatment is rendered extremely difficult because the over-distended and paralysed uterus cannot contract sufficiently to control the bleeding (p. 193). When such a case is recognized by the patient presenting all the signs of internal hæmorrhage and of distension of the uterus as described above, and a doctor cannot be quickly obtained, the midwife should concentrate on the treatment of the collapse and administer 15 to 20 drops of laudanum or other opiate to keep the woman at rest. If medical assistance is still delayed, she should rupture the membranes, give an antiseptic vaginal douche as hot as the patient can bear, put on a tight binder. The escape of the waters will diminish the distension of the uterus and so relieve the abdominal pain, and will allow of retraction taking place to check the bleeding. Should this bring about no improvement, another hot vaginal douche should be given, and the vagina tightly plugged, and an abdominal binder applied as described below. The object is to give the exhausted uterus time to recover and empty itself by its own efforts ; if it can contract sufficiently to expel the child, it will retract enough to check the bleeding, but the attendant must have every preparation made for the treatment of postpartum bleeding. The danger is that the exhausted uterine muscle will not control the bleeding after the birth of the child, and that the already bloodless patient will not be able to stand even a slight postpartum loss.

The Treatment of Shock and Collapse after Hæmorrhage.—After the bleeding is stopped, the patient may die from collapse and anæmia of the brain if measures are not taken to prevent it. These measures must be directed towards combating the shock by warmth and stimulation, preventing anæmia of the brain and vital organs by retaining as much blood as possible in the head and trunk, keeping the patient absolutely quiet, so as to avoid taxing the heart, preventing syncope from heart failure, and finally replacing the fluid lost by the administration or injection of fluid so as to keep the circulation going.

The patient must be wrapped up in warm blankets and surrounded by warm bottles ; hot flannels over the heart are useful ; by raising the foot of the bed on chairs, and by removing the pillows from under the head, an increased flow of blood to the brain may be obtained. In order to retain as much blood as possible for the internal organs, the arms and legs should be firmly bandaged from the fingers and toes to the trunk, so as to express the blood from them into the body where it is more needed than in the limbs. Flannel bandages are the best for this purpose. If they are not available, put warm stockings on the legs and arms, and tear up some long strips of towelling or sheeting and use these as bandages over the stockings. The stockings will serve to retain the heat in the limbs, and this is especially important in the case of the arms, which are often thrown about in the restlessness which is characteristic of serious hæmorrhage.

The administration of fluid is most important, as unless there is sufficient fluid for the heart to contract upon and drive through the blood vessels, the circulation will cease. This fluid also washes blood out of the bones and muscles where it is less needed to the more important vital structures where it is essential to life. The doctor in serious cases introduces the fluid directly into a vein or under the skin—the most rapid way of getting into the body—but it can be more gradually introduced by absorption from the stomach or bowel. If the patient is conscious, she

should be given frequent drinks of warm water, either a spoonful at a time, or better, by means of a feeder. It may be possible to get her to take a small feederful every twenty minutes till two or three pints have been taken. If she is unconscious, rectal injections must be given, and in any case fluid given by the mouth should always be supplemented by enemata of salt solution. A teaspoonful of salt in a pint of water is the correct strength, and, if possible, a pint should be run slowly into the bowel by means of a funnel and long rectal tube or by a Higginson's syringe. If a pint is not retained, half a pint should be given and repeated at intervals of half an hour or so. It is sometimes possible to arrange a tube and funnel so that a rectal injection may be given slowly but continuously for an hour or more. The water injected should always be at a slightly higher temperature than the body—about 100° F. An ounce of brandy can be given when there is marked collapse, but too much alcoholic stimulant must be avoided, as it is followed by reaction later. While keeping the patient warm, it is also advisable to allow plenty of fresh air, as the want of oxygen from bloodlessness is the cause of the air hunger and restlessness.

B.

POSTPARTUM HÆMORRHAGE.

Hæmorrhage occurring immediately after delivery of the child may be due to insufficient uterine retraction, causing a failure of nature's method of controlling the bleeding—*atonic postpartum hæmorrhage*, or to laceration, generally of the lower uterine segment or cervix—*traumatic postpartum hæmorrhage*. The former is the type which causes the most serious hæmorrhage and is the one ordinarily meant when postpartum hæmorrhage is spoken of.

Atonic Postpartum Hæmorrhage.

Imperfect retraction may be due to exhaustion (atony) of the uterine muscle or to retention of whole or part of the placenta. A want of tone (atony) in the uterine muscle may be caused by the exhaustion of prolonged labour (p. 193), over-distension of the uterus, as by hydramnios or twins, or may occur after antepartum hæmorrhage, or in serious constitutional disease of the mother, especially grave blood disease and kidney disease. Rapid extraction of the child when the uterus is exhausted, or too hasty delivery of the placenta, are likely to be followed by deficient retraction, and therefore deficient control of hæmorrhage. Cases of atonic hæmorrhage occasionally arise without obvious cause after a normal labour in a healthy subject. Proper retraction of the placental site will also be interfered with if the placenta or some portion of it is retained. If the placenta remains completely attached, there will be no bleeding, but if only a portion of it is detached, there will be hæmorrhage from the placental site over the detached area and the attached portion will prevent retraction. Similarly, retention of a piece of placenta or of a succenturiate placenta will interfere with retraction. Retention of blood clot is often given as another cause, but there is no evidence that this is the case. The blood clot is the consequence, not the cause of the bleeding. An active uterus would squeeze out the clot ; in a flabby uterus it will form and remain in the uterine cavity. Fibroid tumours of the uterus and distension of the bladder may interfere with retraction and cause bleeding. A patient should not lose more than ten or twelve ounces of blood during her labour, and more than this will be excessive. If due to uterine exhaustion the body of the uterus will be felt to be soft and relaxed and larger than it should be. The hand on the abdomen is on the watch for this. If, therefore, excessive loss occurs, and the uterus is soft and flabby and high in the abdomen, the case is evidently one of atonic postpartum hæmorrhage and immediate steps must be taken to check it. The midwife must act at once. To wait for medical aid might mean that her patient would bleed to death in the meantime.

The symptoms and signs of postpartum hæmorrhage are—(1) An excessive loss appearing externally, followed by (2) the general signs of severe bleeding (p. 212) ;

(3) on abdominal palpation the uterus will be large and soft, indeed it may be so soft that it cannot be easily felt. In rare cases the external bleeding may not be excessive—the blood being retained in the large and relaxed uterus—so that the rule emphasized in regard to antepartum hæmorrhage also holds good here, that the severity of the case must be estimated not merely by the blood seen escaping, but also by the patient's general condition ; some blood is always retained in the relaxed uterus, so that what escapes does not represent the full extent of the bleeding. If there is serious hæmorrhage with a hard and contracted uterus, it is not atonic postpartum hæmorrhage, but is due to laceration of the cervix, and if accompanied by marked collapse, it may be from rupture of uterus (p. 222). In very rare cases inversion (p. 221) may be the cause, but the uterus will not be felt in the abdomen.

A severe case of postpartum hæmorrhage is one of the most serious the attendant on the woman in labour may have to deal with. It may be that in a matter of minutes a newly delivered mother may be in the gravest danger. The subject is so important that it is best taken in detail—First, the preventive treatment ; then treatment before and after the birth of the placenta.

Preventive Treatment includes those points in the management of labour which require special emphasis as important in avoiding hæmorrhage. Bleeding may occur in the third stage in spite of the most careful management, but the careless and impatient will have many more cases than the careful and patient attendant, and in lying-in hospitals and well-managed districts the percentage of hæmorrhage cases after delivery is much less than among lying-in women generally.

The second stage of labour should not be allowed to last long enough to cause exhaustion of the uterus. The midwife should send for assistance in delayed second stage (p. 192). When the pains are feeble, it is dangerous to extract the child's body rapidly ; the retraction may be slow, and insufficient to control hæmorrhage. The old rule, "that the hand on the fundus should follow down the child as it is born," means that if the birth is to be hastened, it must be by expression from above and not by dragging the child out from below, and that the hand on the abdomen will recognize that the uterus shrinks down on the child as it escapes, and will be ready by massaging to encourage contraction should the uterus be felt to become soft. But it is in the third stage that the greatest care must be exercised, and the most important preventive measure is patiently to follow the natural processes in the management of this stage (p. 147). Especially must premature efforts at expression of the placenta and dragging on the cord be avoided, and great care should be taken to ensure that everything comes away. The bladder should not be allowed to become distended ; a catheter should be passed if there is a soft elastic swelling above the pubes. In any case in which from exhaustion, uterine inertia, over-distension, or other predisposing cause, the occurrence of bleeding after labour may be anticipated, special care will be taken, a good supply of boiling water and cold boiled water prepared, and the douche and douche nozzle sterilized to be in readiness for any emergency.

Hæmorrhage before Expulsion of the Placenta.—This is the more usual time for the bleeding to occur, and in order to understand the treatment to be carried out, the midwife must appreciate the state of affairs. Usually the hæmorrhage is due to the placenta being only partially detached, and comes from the detached area. The still attached portion of the placenta interferes with retraction, and it should be kept in mind that the placental site is the last portion to undergo full retraction. Or the placenta may be fully detached and lying loose in the uterus, which remains inert, neither contracting to expel the placenta, nor retracting to check hæmorrhage. Therefore the treatment must be to adopt measures to bring about contraction of the uterus and expulsion of the placenta, or to detach completely the partially detached placenta, and remove it, and so allow full retraction to take place, or if these methods fail, to compress the bleeding area and give time for the exhausted uterus to recover and shrink down into the hard cricket-ball-like retracted uterus as felt in the normal third stage.

In the management of the third stage the attendant was advised to turn the patient on to her back, as the uterus is more easily kept under observation and controlled in this position, and to keep a hand on the uterus in order to watch it.

This hand has nothing to do unless the uterus is felt to become soft and large, or bleeding is seen at the vulva. Then the hand must stimulate the uterus by massaging it through the abdominal wall and endeavour to make it harden again. This is done by sinking the edge of the hand behind the fundus so that the fundus is in the palm of the hand, and rubbing and kneading it with the whole hand, and if it is felt to contract, squeezing it. In the slighter degrees this will suffice and may have to be repeated many times. So long as the bleeding is kept under control by this manipulation, the midwife must await the natural separation of the placenta ; it will take longer than usual owing to the inefficient uterine action, but if the bleeding is controlled she can wait for medical aid if the placenta is not expelled naturally. If, however, the bleeding should continue, she can try to express the placenta from the uterus, but must not waste time on it, as it is not likely to succeed, because the placenta is probably not completely separated, or if it is, and lying loose in a flabby uterus, it may be impossible to squeeze it out of the soft bag. If the uterus is felt to harden under the hand, an attempt may be made to compress it and squeeze it like a sponge. The expression of the placenta from the uterus is always difficult and often unsuccessful, and the method by which the after-birth is expressed from the vagina by pushing the retracted uterus down on to it will not effect its expulsion from the uterus itself. If the uterus cannot be made to harden, attempts at expression may result in inverting the fundus, or, if the placenta is not completely detached, in tearing of the placenta and the retention of a portion in the uterus. The correct procedure is to manipulate the uterus till it is hard, then sink the fingers down behind the uterus with the thumb in front and the fundus in the hollow of the palm, and squeeze from above downwards. If as the result of this the signs of the extrusion of the placenta into the vagina are recognized (p. 148), the retracted uterus should be pressed downwards and backwards till the perineum becomes distended and the cord is forced out of the vulva, when further pressure directed more forwards towards the outlet will effect delivery of the placenta. If the bleeding is severe, and the uterus remains soft in spite of massage of the fundus through the abdomen, the midwife will realize that the case is one of grave emergency, and that as her patient may bleed to death before medical assistance can be obtained, she must act promptly. The woman will not be safe till the placenta is completely detached and removed, and the uterus firmly retracted. She must not waste time by making futile attempts to express the placenta from a relaxed uterus ; she must remove the placenta by hand. This is the only emergency in which the midwife will pass her hand into the uterus, but when it arises she must not hesitate to do so. The one thing she must make sure of is that her hand is surgically clean and no infection is carried up to the uterus, for there is no operation in midwifery which carries greater risk of infection than the manual removal of the placenta. The fingers have to work against the bare uterine wall along the placental site, and the uterine cavity after labour offers a most favourable ground for bacterial growth (p. 28). The hand passed into the uterus to turn the child goes into the amniotic sac, not into a naked uterus, but one lined with membrane which will be extruded later. Realizing the danger of infection, the greatest care will be taken by the midwife to cleanse herself and her patient, a sterilized rubber glove used for the hand to be inserted.

The manual removal of the placenta is carried out as follows. The left hand [1] is passed into the vagina, the right hand presses on the soft distended uterus which will probably be well above the umbilicus. There will be no difficulty in knowing where the internal hand has to go to reach the placenta, the cord in the vagina gives a guide direct to it. Difficulty in reaching the placenta may arise from an " hour-glass " contraction ; if so, the fingers must be pressed in cone-wise, whilst the outside hand pushes down the fundus till the contraction ring is gradually dilated. The external hand so far as possible presses down the fundus, while the internal hand is passed up along the posterior wall of the uterus between it and the membranes. If the placenta is on the posterior wall, the back of the fingers keeping close to the wall

[1] It is not material as to which hand is used for internal and which for external manipulation. The writer prefers to use the left for internal manipulation with the patient on her back, leaving the right free for the introduction of douche nozzles or other instruments, and recommends this to midwifery pupils. But whichever hand can best effect the purpose should be used.

will soon meet with the lower border, and will be passed between the placenta and the uterine wall. As soon as the fingers meet with the unseparated area, they are worked from side to side in a sawing movement so as to complete its separation. If the placenta is on the anterior wall, they will not meet it till they have passed up to the fundus, and will then separate it from above downwards by the same sawing movement, the external hand all the time pressing down the fundus on the internal hand and feeling its movements through the abdominal wall and relaxed uterine wall. In this way the placenta is completely detached. Before removing the hand and placenta the uterine wall must be rubbed between the internal and external hands to stimulate it to contract. If, as the result of this, the hand inside is felt to be gripped by the contracting organ, all will be well. The external hand keeping up the massage will then squeeze down on the internal hand and placenta, and, so to speak, express hand and placenta. The manipulation of the uterus is kept up by the external

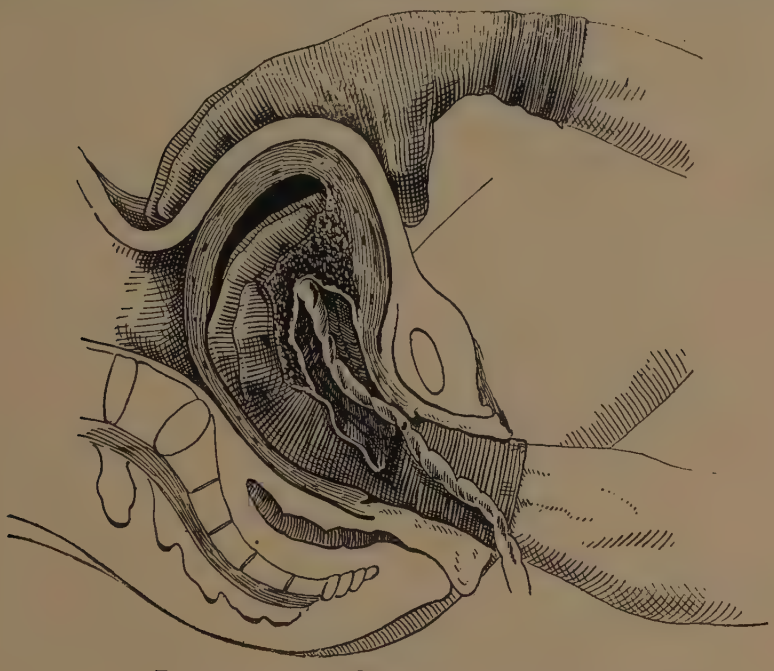

FIG. 104.—MANUAL REMOVAL OF THE PLACENTA.

The internal hand is passed up between the membranes and the uterine wall, whilst the external hand steadies the uterus and presses it down on to the internal hand. The placenta is separated by a sawing movement of the fingers working between it and the uterine wall. In expressing the detached placenta from the uterus, the outside hand is used, as illustrated, to try and squeeze out the placenta.

hand when the internal is withdrawn, and the next procedure, the douching of the uterus, follows as soon as the necessary preparations are completed.

A hot intrauterine douche ought always to be given after manual removal of the placenta, to flush out the uterine cavity and wash out any infectious matter that may have been carried in, and because heat is the best stimulus to uterine action. The fluid used for the douche may be any non-poisonous antiseptic or sterile water, but must be hot, 118° F., or as hot as the back of the hand can bear, and copious.

The long intrauterine douche nozzle must be used, the water being allowed to flow through it as it is passed up the vagina so as to wash that out, and carried up into the fundus where it can be felt by the hand on the abdomen. The fingers of one hand are passed up into the cervix and the nozzle guided along them into the uterus, water flowing all the time. At least a quart should be given, and if the uterus is not firmly contracted, more quarts. Very rarely will this fail, but if it should not check the bleeding the atonic uterus must be compressed till medical

assistance arrives or till retraction occurs. The method of carrying out *bimanual compression* is to pass the left hand into the vagina and, closing the fist, press upwards in the anterior fornix; at the same time the external hand massages the flabby uterus through the abdomen, and, sinking down behind it, presses the posterior wall firmly down on to the internal hand, which in turn presses up on the anterior wall (Fig. 105). In this way the anterior and posterior walls are pressed together between the fist in the anterior fornix and the hand behind the uterus on the abdomen, and this pressure between the hands of the attendant has a similar action to that of uterine retraction; it squeezes the vessels passing through the uterine walls and prevents the blood getting to the placental sinuses. This compression must be kept up till help arrives or till retraction occurs. The arms may get very tired. The left elbow may be supported on the bed, but the right arm will soon become exhausted. In that case an assistant must place her hands over the midwife's external hand and press firmly and allow her to relax the muscular strain on her own arm, and, if need be, to withdraw her hand for the time, the assistant meanwhile keeping up firm

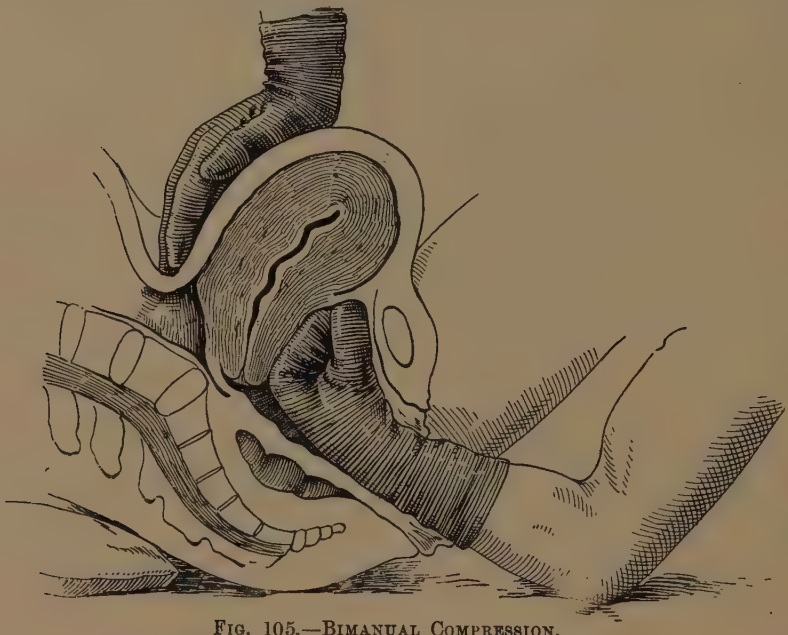

FIG. 105.—BIMANUAL COMPRESSION.

The fist is doubled up in the anterior vaginal fornix and presses against the anterior wall of the uterus; the external hand sunk down behind the uterus presses the posterior wall against the anterior wall. The uterus is thus compressed between the two hands.

Note how the elbow is supported by the bed and how the fingers of the outside hand, by pressing a little deeper into the abdominal wall, will compress the aorta.

pressure. If the uterus is felt to have become hard, the pressure may be relaxed and the hands withdrawn; if the bleeding is controlled, compression will no longer be necessary. If there is further hæmorrhage, it must be resumed till the loss is checked, when measures for the restoration of the patient as already described must be begun (p. 215).

Hæmorrhage after expulsion of the Placenta is due to deficient retraction from want of tone in the uterine muscle, or to retention of a part of the placenta or a placenta succenturiata. The treatment is much the same as in the previous condition, except that there is no longer the need for removal of the placenta. The uterus should be massaged through the abdomen and a hot vaginal douche given. This cannot as a rule be administered quite as hot as an intrauterine, as the vagina is more sensitive than the uterus and as the fluid run into the uterus at 118° is a few degrees lower than that by the time it reaches the vagina. Probably 115° is as hot as can be borne in the vagina only. The vaginal douche is a slight stimulus to uterine contraction, but if it does not succeed in checking the bleeding the mid-

wife must carry the nozzle up into the uterus in the way described above and so stimulate the uterus directly. If this does not effect retraction, bimanual compression must be adopted until retraction occurs or till help arrives. Sometimes the midwife is advised to pass the hand into the uterus to clear out "clots" in cases of severe bleeding after the birth of the placenta. This is not good practice. The danger of sepsis after passing the hand into the naked uterus is so great that it should only be done in cases of grave emergency when the need for it is obvious. This may be so before the placenta is born, or if a large piece of placenta is retained; it is not so after the complete placenta is away. A copious hot douche will wash out the clots and has not the risks of the introduction of the hand.

When the bleeding is controlled, the measures for restoring the patient must be carried out and the midwife must not leave till the doctor has arrived.

FIG. 106.—INVERSION OF THE UTERUS.

(From a specimen in St. Thomas's Hospital Museum.)

The specimen illustrated is one of partial inversion of the uterus. The uterus is seen turned inside out, so that the inner surface of the fundus, with tags of placental tissue attached, is protruding through the cervix and lower uterine segment. Above are the uterine appendages of both sides; the fimbriated ends of the tubes are well shown, and on the right the ovary can be recognized hanging over the edge of the cup formed by the inverted fundus.

The specimen was obtained by Dr. Barnes, and is figured in his *Lectures on Obstetric Operations*, p. 337. His account of the case is as follows: "From a woman aged 27, who had borne one child previously. Half an hour after the birth of the child hæmorrhage set in, the placenta not being expelled. The midwife made traction on the cord; severe abdominal contractions followed, the patient uttering a shriek of pain; the inverted fundus protruded from the vulva. The patient was seen moribund; there was no opportunity of replacement."

In attempting replacement the fingers should be passed up under the cervix to the edge of the inversion—the rim of the cup—and an endeavour made to push up the part which came down last, at the same time compressing the whole inverted fundus. The inverted fold in this way would be raised and the cup would become shallower till the fundus returned.

The use of ergot has not been mentioned as it is not to be relied on for the immediate treatment of postpartum bleeding. Given by the mouth it takes twenty minutes to act, and injected intramuscularly ten minutes, and it has little power to act on the atonic uterus. It should be given in drachm doses of the liquid extract by the mouth or 10 to 15 minims of ergotin may be injected into the muscles of the buttock. It helps to produce retraction and to keep the uterus firm, but of itself will do no good in a severe hæmorrhage. Its chief value is to prevent recurrence of the bleeding. For emergency work a hypodermic syringe is essential, and the best preparations of ergot are these containing its active principle—ergotamine (such as the tartrate sold under its proprietary name of femergin). The extract of the posterior pituitary gland is very valuable, and may be used in the strength of 5 units ($\frac{1}{2}$ c.cm). Both should be injected into the muscles—usually of the buttock.

Inversion of the uterus is happily a rare accident, for it is extremely serious,

causing great collapse. In complete inversion the uterus is turned inside out so as to fill the vagina and protrude externally at the vulva. Partial inversion may occur so that the inner surface of the fundus descends through the os into the vagina.

Inversion may occur either from traction from below or from pressure from above, generally as the result of bad management of the third stage of labour, but possibly also from some abnormality of the fœtus or uterine powers.

Pulling on the cord to deliver the placenta before it is separated from the uterine wall is the way in which inversion is most frequently produced. Suppose the placenta is attached to the fundus and traction is made on the cord ; the fundus will be dragged down by the attached placenta ; if the uterus is relaxed the fundus will be pulled outside, completely inverting the uterus ; if the uterus is contracting and the fundus is pulled down, the contractions will tend to press it down still further and may thus convert a partial into a complete inversion. The same thing may occur as the result of strong uterine action with a very short cord or when the cord is relatively short by being wound round the child's neck, or as the result of a precipitate labour, especially with the mother in the erect position.

Inversion may also be produced by efforts at expressing the placenta from a relaxed uterus or by over-vigorous kneading for postpartum hæmorrhage. Strong pressure on the fundus may depress it so much that the uterus turns inside out at once, or it may produce a partial inversion which will be made complete by uterine contraction squeezing the fundus farther and farther down.

Very severe collapse of the patient results from inversion, and, if there is any separation of the placenta, serious hæmorrhage will occur from the separated area, as uterine retraction is absent. There is no difficulty in recognizing the cause of the collapse. A large rounded red mass protrudes at the vulva or fills up the vagina, generally with the placenta still attached to it. On palpation of the abdomen the body of the uterus will not be felt. The only thing inversion could be mistaken for would be a fibroid tumour of the uterus, but in this case the uterine body would be felt in the abdomen.

Should the midwife be unfortunate enough to meet with a case of inversion, she must at once send an urgent message for a doctor, and meantime apply measures to combat collapse as on p. 215.

If the services of a doctor cannot be obtained at once and there is serious hæmorrhage, the midwife must attempt emergency treatment. If the placenta is completely attached and there is little or no hæmorrhage, she must not attempt separation in case furious bleeding results ; let well alone. Should there be hæmorrhage from partial detachment, it is best to complete the separation and remove the placenta. The raw inverted surface should be washed over with a hot antiseptic solution (temperature 115°), and towels wrung out of hot lotion pressed on it. If bleeding is checked, again leave things alone ; if bleeding persists, the inverted fundus is then grasped in the palm, squeezed by the fingers, and steady pressure made upwards and backwards. The object should be to push back the part which came down last, *i.e.* the highest part of the protrusion, and then the rest will follow. Meantime the other hand is placed on the abdomen to receive the uterus as it returns, and to prevent its being torn away from its vaginal attachments by too violent and sudden pressure. Care must be taken not to push the fingers through the relaxed uterine wall. Collapse must be treated, as, quite apart from loss of blood, shock is often so severe as to prohibit any attempt at reposition. The midwife would, therefore, only attempt it because of bleeding and because sometimes the uterus can be easily replaced, if manipulation is undertaken at once. If bleeding continues and replacement is impossible, a hot douche (temperature 118° F.) and firm pressure with gauze or towels or any clean boiled material must be tried.

Traumatic Postpartum Hæmorrhage.

This does not occur from the placental site from want of retraction but from laceration of the uterus or vagina, most commonly of the cervix. If there is a serious rupture of the uterus, the symptoms of collapse will be present.

Tears of the lower genital tract and perineum rarely bleed much, and are generally obvious and can be controlled by pressure with the fingers or a wool sponge. Cervical lacerations are those which most commonly require treatment. The midwife can recognize that the bleeding is not atonic postpartum hæmorrhage by the uterus being felt hard and well retracted. The loss is not usually severe but keeps on, and when pressure is made on the fundus and blood and clot expressed from the vagina (p. 150), more is expelled than should be. Under such circumstances a hot

vaginal douche should be given at 115° or as hot as the patient can bear. This will stop oozing from the torn vessels and will suffice unless a blood vessel of some size is torn. If this, therefore, is insufficient, some method of compressing the bleeding area must be adopted. It is no good trying to find the actual bleeding spot with a view to compressing it with the fingers or a plug ; it is impossible to do so without assistance and a good light as well as a speculum and special forceps to pull down the cervix. Therefore the whole vaginal vault must be plugged with gauze or other suitable material (p. 210), if the bleeding is serious, and then by passing the hand into the vagina, doubling the fist, and pressing the gauze upwards with the fist whilst the external hand presses the uterus firmly down on the gauze, firm compression can be quickly obtained. When more material for plugging has been obtained the rest of the vagina can be plugged, each layer of plugs being pressed firmly upwards as it is passed. Then a graduated compress must be arranged over the uterus and a binder with a perineal band put on so as to keep up the compression of the cervix between the plugs below and the body of the uterus above.

These cases are rarely so urgent as the atonic bleeding, so that except in very out-of-the-way places the midwife will be able to await medical assistance, and, in emergency, can apply bimanual compression by means of gauze or other dressing pressed upwards by the first in the vagina and pressure downwards of the uterus on to the dressing till help arrives.

Secondary Postpartum Hæmorrhage.

As this unsatisfactory term is used in the C.M.B. Rules (E 21 (4)), it calls for some explanation. The condition has no direct relation to postpartum hæmorrhage as described in this chapter. It includes all cases of excessive loss occurring from six hours after delivery. Occasionally a sharp hæmorrhage may occur a few hours after delivery, but it is readily controlled by massage and compression of the uterus through the abdomen, a vaginal douche as hot as the patient can bear, and a dose of ergot. Should this fail, a hot intrauterine douche or bimanual compression will enable the midwife to control the bleeding till the doctor arrives. The more frequent cases are those of excessive amount and persistent redness of the lochia, accompanied by delayed involution of the uterus, and generally due to retention of some portion of the after-birth. Medical aid should be obtained. The causes are mentioned on p. 229.

CHAPTER XXI.

ECLAMPSIA.

Nature of the Disease.—Eclampsia is a disease of pregnant and lying-in women which is brought about by some poison or poisons (the exact nature of which is not known, though the placenta is probably the source) which obtain entrance into the maternal circulation and thus injuriously affect all the tissues of the body. The kidneys and the liver are the organs most damaged by the poison, because one of the functions of the liver is to modify and destroy deleterious products in the blood and the function of the kidney is to excrete waste matter by the urine, but the blood vessels, the heart, the nervous system, and so on, also suffer in some degree. It will be evident from the fact of the liver and kidneys being specially affected that their functions of modifying and excreting injurious substances in the blood will be impaired, so that as the disease progresses these organs become less and less capable of preventing an accumulation of poison in the system, so that a " vicious circle " is established. Besides the true eclampsia there are other manifestations of this poisoning (or toxæmia) of pregnancy, such as malignant jaundice (acute yellow atrophy of the liver), toxic vomiting, kidney disease, etc. The description of eclampsia as due to " kidney disease " is not accurate and should be avoided, though it has some truth in that the kidneys very rarely escape damage and that, as will be seen later, the symptoms from the affection of the kidneys are often the most prominent and striking.

Though the nature and source of the poisoning in the conditions grouped under the " toxæmia of pregnancy " are unknown, it is clear that these diseases are due to a poisoning because the damage to the tissues and the clinical features are those found in other poisonings.

Manifestations of Eclampsia.—Having now obtained a conception of what the disease is, the next thing is to consider how it shows itself in the patient. The word " eclampsia " signifies " fits," and fits are the chief and most striking feature of the disease when it is fully developed. As there is a stage in the disease which can often be recognized before fits supervene and as this stage is a most important one for the midwife, in that if the patient is treated the onset of the full eclamptic condition with convulsions may be averted, it must be studied in detail.

Pre-eclamptic Stage.—The symptoms of the pre-eclamptic or premonitory stage are first those of a general poisoning of the system, and secondly those of damage to the kidneys and, in a lesser degree, to the liver. The symptoms of toxæmia, or general poisoning, are headache and sickness, with furred tongue, sallow complexion, and sometimes a yellow tinge in the whites of the eyes. Occasionally there may be dimness of vision or spots before the eyes, buzzing in the ears or deafness, and giddiness. The patient may suffer from sleeplessness or she may be drowsy, and, in very bad cases, pass into coma. The damage to the kidneys shows itself by the passage of a greatly diminished amount of highly-coloured urine, with puffiness of the face and hands, and perhaps general dropsical swelling. The urine when examined by the usual boiling test [1] will be found to contain albumin ; in some cases it will form a white cloud, but in very bad cases it may go solid like boiled white of egg, so that if all the urine in the tube is boiled, the tube can be turned upside down without anything escaping. The dropsical swelling or œdema affects mainly the loose tissue under the skin in various parts of the body. Such loose tissue is present under the eyes and in the eyelids, over the back of the hands and feet, over the shins, in the lower part of the abdominal wall and in the flanks, and

[1] A teaspoon may be used when a test-tube is not available (see pp. 19 and 83).

in the labia. These parts of the body should be specially examined for œdema.[1] It must be remembered, however, that the feet and legs and lower part of the abdominal wall may swell slightly from the pressure of the pregnant uterus, and, therefore, that swelling of these parts is not so distinctive as that of the face and hands. The patient may notice that her eyes are swollen and puffy on waking in the morning, though this may wear off during the day in consequence of the muscular movement of the eyelids pressing out the fluid. The appearance of the face in a well-marked case is puffy and bloated and of a pale pasty hue owing to anæmia. Such an appearance should always suggest careful investigation of the patient's condition and an examination of the urine. It should be remembered that eclampsia is more common in primiparæ than in multiparæ, and, as it is due to a poison produced in the placenta and not to any previous disease in the mother, the chances are that it will occur in perfectly healthy women. Naturally, in women who have suffered from kidney disease and in whom the excretion of waste matter is defective, the danger, should the eclamptic poison be formed, will be greater than in women with healthy excretory organs, but if the midwife discovers that her patient has been under treatment for kidney disease, she should advise medical assistance on this ground and without waiting for further developments. Again, the pre-eclamptic stage may be well marked, and of long duration, or it may be but slightly marked and very short. In a small proportion of cases of eclampsia, the onset is acute and the premonitory stage so short as to give little opportunity for the prevention of convulsions, but with careful observation almost all should be detected by the midwife in time for treatment to be adopted, so that the disease may be checked before it has developed as far as the stage of convulsions.

The Prevention of Convulsions depends on the early recognition and treatment of all cases of albuminuria—hence the importance of regular and routine examination of the urine—and of the premonitory symptoms mentioned.

The Eclamptic Convulsion.—The eclamptic convulsion itself may occur during pregnancy, labour, or in the puerperium, but most frequently during pregnancy, although the onset of labour is often determined by the onset of convulsions. In character it is very similar to an epileptic fit. It generally begins with slight twitching of the eyelids and movements of the eyes and head to one side. Then the muscles of the body become rigidly contracted (the tonic stage), the head is thrown back, the jaws clenched, the back arched, and the limbs thrown out stiffly. Owing to the tense contraction of the muscles of the chest and abdomen, breathing is impeded and the woman becomes blue in the face. After a few seconds the rigidity passes off and the muscles are thrown into convulsions (the clonic stage), the face and limbs twitching, and blood-stained froth escaping from the mouth. This stage lasts one or two minutes, and as it subsides there is general relaxation of the muscles and the breathing becomes noisy and rattling (stertorous). When the fit begins the patient loses consciousness, and this lasts for a variable period afterwards. If a considerable time elapses before another fit occurs, she may be first dazed and stupid and then gradually become sensible, but more often she remains more or less comatose till the next fit comes on, and with each succeeding one the coma becomes deeper. The blueness of the face (cyanosis) often persists, and, when unconsciousness remains and other fits follow, may continue throughout the attack. The chief characteristic of the fits is their tendency to recur ; in severe cases this may happen every five or ten minutes, in the less serious only after many hours. When fits are frequent and the patient is deeply comatose and cyanosed with rattling noisy breathing, the actual convulsion is often shown only by a sudden clenching of the teeth and stiffening of the body, followed by a slight twitching. During the muscular relaxation following the fit, the urine — if any is secreted — is passed unconsciously and also the motions. For this reason any specimen of the urine ought to be carefully saved for the doctor, as it may not be easy to obtain one at a later stage in the disease.

[1] The presence of œdema is ascertained by pressing on the skin with the finger and noting whether a " pit " or impression of the finger-tip is left. This is best seen over a bony surface like the shin. Over soft tissues, as in the lower abdomen, the skin may be pressed between two fingers to see if pitting occurs.

Diagnosis.—The diagnosis of eclamptic convulsions from epileptic fits, hysterical fits, apoplectic attacks, and so on, is not of any importance to the midwife. In any case of fits she must obtain medical assistance, but it might be as well to state that epileptic fits occur generally in a patient subject to them, that the urine is not affected, and that they are generally single and not repeated as in eclampsia.

Prognosis.—Eclampsia is a very serious disease ; about one in every five cases proves fatal, but it varies greatly in severity. When the fits occur at or just before the onset of labour and recur frequently, leaving the patient comatose and deeply cyanosed, only about one in four will survive. The patient rarely survives when more than twenty or thirty fits occur. In regard to this it may be noted that fits cause a rise of temperature, and therefore when they are frequent the temperature rises to 104° or 105° ; hence a high temperature is a bad sign. The child, too, is frequently stillborn, owing to the cyanosis and embarrassed respiration of the mother and to the operative measures required to hasten delivery.

Management.—The midwife's duty in a case of eclampsia is quite plain. If she has noticed any symptoms of the pre-eclamptic stage, she will already have had medical advice ; if the convulsions come on without warning, she must at once send for assistance, and meantime render first aid to her patient till the doctor's arrival. " Fits or convulsions " are specifically mentioned in the C.M.B. Rules under pregnancy, labour, and lying-in as requiring medical help.

She must prevent her patient from injuring herself. Should the patient have the first fit when out of bed, she must be allowed to lie where she falls and be put to bed when the fit is over. The midwife must loosen any bands about the neck, so as to allow ease of breathing, turn the face on one side and put a handkerchief or the end of a towel into the corner of the mouth to allow saliva to escape and not be sucked back into the air passages, and any tooth-plate or loose teeth that might choke the unconscious patient must be removed. When the jaws come together during the tonic contraction of the jaw muscles, the tongue may get between the teeth and be severely injured. It is these injuries to the tongue which cause the bleeding from the mouth. The moment a fit is noticed to be beginning, the handle of a spoon or a piece of wood wrapped in a handkerchief or towel should be forced flatwise between the teeth at the side and then turned endwise, so as to keep the jaws apart till the fit is over. No small article, like a cork, which may slip from the fingers into the mouth and so choke the patient, ought to be used. When the doctor is within easy reach this will be sufficient till he arrives. When there is considerable delay before the doctor can arrive, the midwife may begin some of the simpler and undisputed methods of treatment. If the patient is unconscious, no attempt should be made to give her anything by the mouth, in case it is sucked into the lungs, but if she recovers sufficiently to take fluids, let her be given first a strong purge and then as much water as she will drink so as to flush out the poisons from the body. For the purge any strong aperient which the midwife carries or which is in the house may be used—castor oil, Epsom salts, and so on. The milder ones, like liquorice powder, are little use, and if the salts are given they should be given in a big dose ; half an ounce (a tablespoonful) either in one or in repeated doses and with plenty of water. When there is a long delay in obtaining medical assistance and the midwife happens to have calomel with her, 5 grs., or a 5 gr. tablet crushed up, may be mixed with a little butter and put carefully on the back of the mouth. Otherwise a big soap and water enema with an ounce of turpentine may be administered, though it must not be forgotten that any manipulation of this kind may provoke a fit. When the enema has acted, saline solution (*i.e.* a teaspoonful of salt in a pint of water) may be given by the bowel if it can be retained, and repeated every twenty minutes as long as it is absorbed. In doing this not more than the pint should be given at one time and less if there is a tendency for it to be returned ; it is better to give it repeatedly and in small quantities. Hot packing may be used to promote sweating—either a wet pack or a dry pack with hot bottles wrapped in flannel. The wet pack has the advantage in controlling the fits better, but is more difficult to carry out in a small house. It means wringing out blankets or sheets in boiling water and wrapping the patient up in them (see p. 304). In dry packing great care must be taken not to get the bottles too near the patient's skin, as severe burns are easily caused in the unconscious

patient. By such means excretion is promoted by the kidneys, bowels, and skin, and this is the best means of fighting the disease.

Midwives working abroad or in isolated areas where medical aid may be long in reaching them should be provided with some sedative to control the fits for use in emergency. Chloral (40 grs.) or chloral and potassium bromide (30 grs. of each) or tincture of opium (15 to 20 minims) may be given in a rectal injection of half a pint of warm water. The chloral or chloral and bromide may be repeated at three-hourly intervals till four doses have been given. The most effective method of controlling the fits is a hypodermic injection of morphia (gr. $\frac{1}{4}$ or $\frac{1}{3}$), which may be repeated in four hours if the fits continue. Naturally, those midwives working under such conditions must have special instructions from their medical superiors as to what they should do while awaiting assistance and must be guided by these instructions.

PART V.—THE PUERPERIUM.

CHAPTER XXII.

THE NORMAL PUERPERIUM.

Strictly speaking, the puerperium comprises the time during which the genital organs and tract return to their normal size and condition after pregnancy and labour, *i.e.* the time occupied by the processes of *involution*. This is about six to eight weeks. It is, therefore, longer than the month, for which the monthly nurse is commonly engaged, and much longer than the time for which the midwife ordinarily attends her patient. According to the regulations of the C.M.B. : " The midwife shall be responsible for the cleanliness, and shall give all necessary directions for securing the comfort and proper dieting of the mother and child during the lying-in period, which shall be held, for the purpose of these regulations, and in a normal case, to mean the time occupied by the labour and a period of ten days thereafter. Should the midwife for any reason continue her attendance, after the tenth day the fact must be noted in her Register, with the explanation of the reason. If after ceasing to attend a case the midwife is again called in to an illness of the mother or the child connected with the confinement, all rules under Section E (in so far as they are appropriate to the case) shall apply " (E 12). As rules are those laying down the conditions in which medical help must be sent for, this means that although the instructions regarding the management of mother and child will be chiefly confined to the ten days during which the midwife is responsible, the consideration of the physiological (normal) and pathological (abnormal) processes of the puerperium must be extended to the full limit of six to eight weeks.

The Physiology of the Puerperium.

comprises chiefly—(1) The healing of the raw surface in the interior of the uterus left after the separation of the placenta and membranes ; (2) the return to their normal condition, or involution, of the organs and parts of the body altered and disturbed by pregnancy and labour ; and (3) the establishment of a new function, lactation. The healing process by which the interior of the uterus becomes covered with a new lining membrane (endometrium) must first be considered, and this involves a description of the discharges (lochia) which flow from the uterus during the process of healing.

It has already been mentioned (p. 56) that the separation of the placenta and membranes from the uterine wall takes place through the deep part of the spongy layer of the decidua, leaving the deepest or unaltered layer of the endometrium attached to the muscular wall, from which grows the new endometrial lining. The process is very like that of the healing of a large skin graze ; there is oozing of blood from the small vessels on the surface (bleeding from the larger ones being controlled by compression by the retracted uterine muscle fibres and later by the formation of clot) ; as the oozing diminishes the discharge becomes more watery (serous), and as the new skin, or endometrium in this case, grows over the whole surface, gradually ceases. With the discharge are cast off fragments of decidua and any small remnants of membranes that may have remained in the uterus.

The Lochia show these changes, and careful observation of their appearance and character is therefore of great importance as an index of the progress of the healing of the endometrial surface.

For the first day or two the lochia are almost pure blood and may contain small clots and shreds of membrane. By the third day the discharge is still coloured with fresh blood pigment, but is more watery and contains more mucus from the glands of the cervix. It is sometimes described as pink, to indicate that it is serous fluid and mucus coloured with blood rather than pure blood. From the fourth day onwards the lochia become brown and no further evidence of fresh blood colour should be seen. The brown colour is due to old and altered blood and débris which is being squeezed out of the uterus as it shrinks down. By the end of a fortnight the discharge has usually ceased, though a brownish mucoid discharge may persist for a little longer. The persistence of bright blood in the lochia or the recurrence of fresh bleeding after the discharge has become dark and diminished in quantity is a sign of the healing being incomplete,—often as the result of some retained portion of placenta or membrane.

By the time the lochia take on a brown colour they have a slightly stale or sickly odour, but ought never to become offensive.

In quantity the lochia vary considerably (average 8 to 12 oz.). Some women habitually lose more than others, *e.g.* often those who lose freely at the menstrual periods and those who do not suckle their baby. The lochia are sometimes diminished in amount in fever and illness.

Involution.—After labour the uterus reaches up to the level of the umbilicus and weighs 2 lb.; by the time involution is complete it has shrunk down so as to lie entirely in the pelvis and weighs 2 oz., *i.e.* as many ounces as it did pounds. This shrinkage is due chiefly to the disappearance of the increased muscular development which took place throughout the nine months of pregnancy.

Body of Uterus.—The involution of the body of the uterus can be watched by the midwife by observation of the height of the fundus as felt by the abdomen. Immediately after the birth of the placenta the uterus is felt as a hard ball reaching nearly to the level of the umbilicus or 5 to 5½ inches above the pubes. Twelve hours later it will probably be found a little higher than this, and perhaps not quite so stony hard, because some slight relaxation of the original firm contraction has occurred. In the course of a day or two, careful measurement will show that it is diminishing in size, so that by the end of a week it reaches only 2½ to 3 inches above the pubes, and by the tenth day or so cannot be detected by abdominal palpation. Thus from 5¾ inches above the pubes it has sunk so low in the course of ten days as not to be measurable, approximately at the rate of a little over ½ inch a day. In a week it is half, and in a fortnight less than a third its original weight and size, and then it slowly shrinks to nearly its size and weight before pregnancy.

Observation of the rate of involution of the body of the uterus must be carefully carried out by the midwife; any marked delay, especially if accompanied by other signs that the puerperium is not proceeding normally, must be reported to the doctor. Involution is slower in unhealthy and anæmic women, in non-nursing mothers, and is delayed (subinvolution) by retained portions of placenta or membranes, by fibroid tumours, and in septic conditions. In measuring the height of the uterus during the lying-in time care should be taken that the observations are made after the bladder is emptied. A full bladder will raise the height of the fundus. Distension of the colon has a similar effect and therefore constipation may also give rise to error.

Cervix.—During the birth of the child the uterus, cervix, and vagina become one canal, and all differentiation between them is lost (p. 102). After the child is born and before the placenta comes, owing to the retraction of the lower segment, the cervix partially re-forms, and after the third stage becomes quite distinct. Its thick soft lips can be felt projecting into the canal and marking the opening into the uterus, but the opening is still very wide, so that the hand can readily be passed inside. During the first week the cervix contracts down so much that by the end of this time it will barely admit a finger, and by the end of a month, not more than a glass catheter. By the time involution is complete, a knitting-needle is about all it will take. In delayed involution from retained products or other cause, the canal will remain open much longer than usual, and indeed will probably not close down till the uterus has expelled the retained material or until it has been removed.

Vagina.—During the passage of the child the vagina is greatly stretched and its folds (rugæ) are all smoothed out, and though these folds form again soon after labour, the canal remains very distensible, so that it will easily contain the whole hand. In a few days the muscles surrounding it shrink down and its walls contract, so that, if there has been no undue laceration, in the course of a week or so it will not admit more than two fingers.

Other Parts.—Similarly, the vulval outlet and perineum shrink and tighten after their stretching, and the whole pelvic floor recovers its tone and firmness, though it never becomes quite as strong as before labour.

The peritoneum, which was stretched by the growing uterus during pregnancy, also shrinks, and the increased mass of loose connective tissue formed in the broad ligaments and elsewhere is absorbed.

The abdominal walls also recover partially from the stretching; the skin, if it has cracked much, is permanently looser, and the muscular and other structures may also remain slacker than before pregnancy.

Lactation.—During pregnancy the various pockets of gland substance or lobules of the breast become hard and can be felt against the chest wall, and a yellowish fluid (colostrum) can be squeezed from the nipple. Not till the third or fourth day does the true milk begin to be formed. The breast lobules become harder and the whole breast more tense, and milk is easily expressed from the nipple. This milk is formed by the mammary gland. The cells lining these pockets select substances from the blood and manufacture them into milk which collects in these pockets and finds its way by fine ducts to the nipple. Sometimes at first the pockets get overfull and become very tense and hard, and, owing to the narrowness of the ducts, which easily become blocked, there may be some difficulty in emptying them. When a lobule becomes over-distended in this way it can be felt as a hard lump in the breast. The establishment of lactation is usually unaccompanied by any disturbance of the patient, but if the breasts become much engorged and hard or "caked," there may be pain and some rise of temperature.

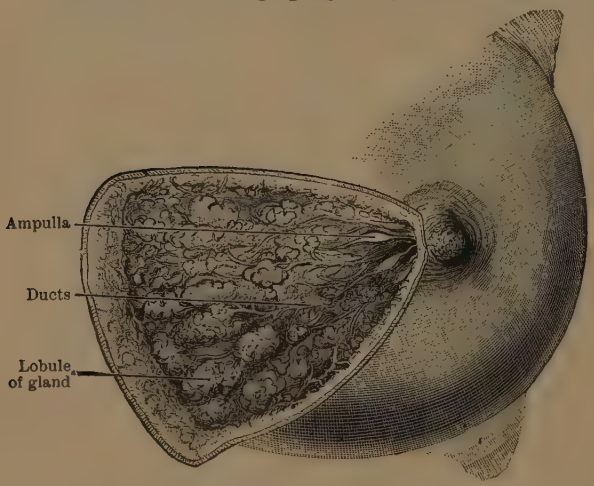

FIG. 107.—STRUCTURE OF THE BREAST.
The ducts draining the lobules are seen to have a small dilatation or reservoir (ampulla) before opening on the nipple.

Afterpains.—For some days after delivery the uterus continues to contract and relax, these contractions aiding in the expulsion of blood clot and fluids from the uterus. As a rule these postpartum contractions are not felt by the patient, but sometimes they are painful enough to keep her awake. These afterpains are noticed more often by multiparæ than primiparæ, and after a pregnancy in which the uterus has been more distended than usual (*e.g.* twins, excess of liquor amnii); also they cause more distress in highly-strung nervous women. Sometimes the afterpains are excited by the presence of a large blood clot in the uterus or by retained portions of membrane or placenta, as shown by the fact that they often cease after the clot or membrane is passed. Putting the child to the breast also stimulates the uterus to contract, and sometimes this is the only time the pains are noticed. The midwife will recognize that these pains are true afterpains and not serious abdominal pain by their spasmodic or occasional character,—they come and go like other uterine contractions; by their being excited reflexly by nursing, by manipulating the uterus, after a hot douche, and so on; by there being no general effect on the mother, no rise of temperature or pulse rate. When they are severe enough to disturb the patient's

rest, 30 drops of liquid extract of ergot should be given in warm water. That causes firm continuous contraction of the uterus and expulsion of clots. In very bad cases small doses of opium or other sedative may be necessary.

The Management of the Lying-in Mother.

The first thing the midwife must realize in regard to the lying-in mother is that although she is not a sick woman she may readily become one, and that the interior of the uterus may be easily infected if there is any relaxation of the precautions against sepsis. Though septic infection is the chief and greatest danger, there are other troubles which must be guarded against, and in every case the attendant must keep her patient under the most careful observation so that early warning is obtained of any trouble.

The midwife's duty is therefore twofold—(1) As a nurse, to do all she can to make her patient comfortable and thus give her the best chance of making an easy and speedy recovery, especially taking every possible precaution against sepsis; (2) to keep careful watch for the slightest sign of commencing disease and to obtain assistance at once should there be any evidence of this.

Sleep.—The lying-in woman ought to sleep well. After the exertion of labour she requires rest and generally falls asleep at once. The minor discomforts which may cause loss of sleep—afterpains, soreness of the vulva, piles, distension and pain in the breasts, and so on—must be mitigated so far as can be and the lying-in room kept quiet. If the child is noisy it must be removed for a time and all sources of worry to the mother avoided. When a patient is inclined to be sleepless a good plan is to try gentle massage, especially to the back and neck, after she has been washed and made comfortable for the night. A drink of hot milk is often useful.

A patient who is sleepless is always a source of anxiety; septic troubles and mental disease are often preceded by sleeplessness. When there is marked or prolonged sleeplessness medical advice should be obtained.

Diet.—While the patient is in bed the diet should be light and easily digestible, but there is no need to restrict it as if she were suffering from some illness. Resting in bed she requires little till lactation commences, and her own desires generally are in the direction of a simple diet. Milk and milk puddings should form the staple articles of diet, but there is no reason why she should not have fish, chicken, or a mutton chop, and once the bowels have acted she can have a wider selection. The popular notion that "milk doesn't make milk" has no basis in fact, and the more milk the nursing mother can drink the better. Alcohol is not required, and the superstition as to the value of stout may be dismissed. Some patients will eat better with a little alcohol with their meals, and so far it may be of use, but in itself it is not a source of strength. Extract of malt in dessertspoonful doses contains more nutritious matter than a glass of stout.

Position.—It is usual for the patient to lie on her back for the first day or so after delivery; it allows of easier drainage from the uterus as the fundus is then the highest and the cervix the lowest part of the uterus. Lying on the side soon after labour with the relaxed abdominal wall may allow the fundus to fall over to that side, so that the discharges may collect in it if it is not firmly contracted. Also, if there is much bruising and laceration of the vulva and perineum, the patient will be better kept quietly on her back. But sleep is more important than any of these considerations, and if the woman complains that she cannot sleep easily on her back, let her be turned on her side and then again on to her back when she is awake. After the second day she ought to be propped up with pillows and sit up for a time each day, and if there are no lacerations and her condition is quite normal, she ought to be encouraged to move about in bed. This prevents muscular wasting and promotes drainage from the uterus and activity of the circulation, and so helps the return to the normal.

The question as to how long the patient ought to be kept in bed is one that is not easy to decide, though it is often determined more by the social position and domestic necessities of the family than by what is best for the patient.

Why, after the natural process of childbirth, should a woman require more

than a little extra rest after the labour? Why should she spend days or even weeks in bed after an uncomplicated labour? This subject is deserving of a little consideration, because for several years past there has been a movement in favour of early rising, even as soon as one, two, or three days after delivery. The reasons for keeping a patient in bed are—(1) Whilst in bed the patient is easily looked after; she is under control and observation in a way that is not possible once she is given the liberty of even so little as sitting up in a chair in her bedroom. (2) Absolute rest is the best means of avoiding certain complications and allowing of the natural processes of healing and repair. Such risks as floodings and thrombosis and embolism, rare though their occurrence may be, are best avoided by lying quiet in bed. There is always the chance of septic infection occurring during the early days of the puerperium, and the careful nursing by which this is avoided is more easily carried out with the patient in bed. (3) For a week or two after labour the uterus is large and heavy, the abdominal and pelvic muscles are stretched and relaxed, and it is therefore easy for displacement or dropping of the womb to occur, if the woman assumes the erect position or, still more, if she should perform any straining act. This is most easily prevented by keeping her in bed until the uterus has sunk down into the pelvis and its muscular and ligamentary supports have become firmer. (4) The nervous strain of pregnancy and labour is followed by the further strain of nursing and care of the infant. In the lower classes this is not so great as in their more educated and highly-strung sisters of the richer classes, among whom the excitable and nervous temperament is more often seen. The hard-working woman has little time to think and worry about pregnancy and labour and her baby, and goes through it in a matter-of-course way. But in women of a higher social position, pregnancy makes much more difference to their lives and is much more in their minds; this strain culminates in the strain of labour—very often the hardest day's exertion the woman may have to do—and then is succeeded by new duties and the new tax of suckling the infant. Therefore the prolonged mental and physical rest—a modified rest cure—is a most valuable and beneficial change for them. When the patient can afford it, three weeks' rest in bed with freedom from visitors and domestic worries, followed by another week or two of fresh air and gentle exercise before taking up her ordinary social and domestic duties, is a great advantage in allowing of complete recuperation from the nervous and mental strain she has undergone. The more rest the woman in the poorer classes can obtain at this time the better for her. Frequent childbearing, early rising, and early return to household work is the reason why the working woman so soon looks old and worn beyond her years. That is why the quiet and rest and absence of domestic worry which a fortnight in a lying-in institution gives to the poor mother with one or two rooms and a large family, are so beneficial. It gives just that time of recuperation which diminishes the wear and tear of the human machine.

If these considerations favour two or three weeks' rest in bed, what is to be said for limiting the stay in bed to three or four days or less? The great objection to prolonged rest in bed is the slackness and wasting of the muscles, produced by disuse and want of exercise while lying quiet. And it must be remembered that it is muscular support which maintains the organs in position. Also the circulation is less active and the physiological activities of the body as a whole are diminished by prolonged rest, and with them the healing processes which are an essential part of the puerperal state. The question, therefore, resolves itself into a consideration as to how best the advantages of rest and nervous recuperation can be obtained without the disadvantages of muscular wasting and sluggishness of the physiological processes. First of all, the individual characteristics of each patient must be taken into account. A woman of the heavy phlegmatic type, especially if inclined to stoutness, would be better if allowed to rise earlier than a bright, excitable, highly-strung woman of thin and spare build. A woman who takes her domestic duties very much to heart and is easily worried and upset by trifles would naturally benefit by being kept from any knowledge or part in the household for much longer than one who bothered herself little about such matters. Again, the progress of the patient during the lying-in time must also determine its duration. A woman who has slept well and eaten well and who has made an uneventful recovery would naturally be

allowed to rise and return to her duties before one who has bad nights and recovered slowly. Slow involution of the uterus and persistence of a bright lochial discharge indicate the need of a longer stay in bed, and, naturally, patients who have had a long and exhausting labour or have laceration of the soft parts or any puerperal complication will require more than the usual allowance in bed. If it were possible, the best thing would be to keep a patient in bed for about three weeks, quiet and free from visitors, and during that time, to obviate the muscular weakness, she should have massage and special exercises—" bed gymnastics " as they have been called. This, however, is only possible in a very limited class and quite out of the question in district work. The district patient cannot generally afford the luxury of more than ten days in bed, and the attendant should endeavour to make that time as restful to her as possible. After the second day she should sit up in bed, and later, move about in bed and exercise her muscles without getting out of bed. Before she is allowed to rise, the uterus ought to have sunk down into the pelvis ; the lochia should be small in amount and not bright in colour ; the temperature and pulse rate should be normal and the patient sleeping well and feeling well.

Temperature.—During the lying-in time the temperature ordinarily does not rise above 99°, and the pulse rate is generally under 80 and sometimes falls as low as 60. The causes of disturbance of temperature and pulse will be mentioned later.

Whilst the patient is in bed and the diet modified there is a tendency to constipation, and there may be difficulty or inability to pass urine. The latter is largely of nervous origin, but may be aggravated by bruising and swelling about the urethra, the relaxed abdominal walls, and the position in bed.

The midwife's duties to the mother after labour are (1) nursing and (2) observation.

The Nursing of the Lying-in Mother.

In regard to this, the C.M.B. regulations say " she shall be responsible for the cleanliness, and shall give all necessary directions for securing the comfort and proper dieting of the mother during the lying-in period." She should, therefore, visit her patient not later than twelve hours after the labour and daily afterwards till the tenth day ; if there is some complication she must visit as the medical practitioner directs. The visits should not be made always at the same time each day, but should be varied—sometimes in the morning, sometimes in the evening. She should see that the room is well aired and ventilated and that the mother is properly washed. The face and hands should be washed twice a day and the body sponged over at least once a day, and twice if possible, and the hair brushed once. The pads should be changed when soiled and the vulva sponged over with an antiseptic lotion. For the first day the pads will require frequent renewal, possibly every hour or two, and afterwards every three or four. The old custom of scorching the pads at the fire before use is an excellent one, as it not only dries and warms them but to some degree sterilizes them. The patient should have a draw-sheet under her, which should be moved and changed when necessary. If there is much bruising and swelling of the vulva, hot boracic fomentations will relieve the pain and discomfort. Douches are not required in normal cases.

An action of the bowels should be obtained not later than the morning of the third day, and for this nothing is better than a full dose of castor oil, which gives a soft relaxed motion. Generally an ounce or nearly that is required, and it is inadvisable to give too small a dose which will often bother the patient by causing colic and frequent small actions, whereas a full dose acts promptly ; if the patient is troubled by incomplete actions, a soap and water enema is the best remedy. Castor oil takes from two to four hours to act, and ought therefore to be given about 3 or 4 a.m. to obtain a result in the early morning. Afterwards some aperient the patient is accustomed to take will be best, so long as it is remembered that more will be required than when she is up and about. If there is any difficulty in passing water, the patient should be allowed to turn on to her hands and knees or sit up if there is no complication. Should the change of position not suffice, fomentations to the vulva and abdomen must be tried, and hot water in the chamber. If other means fail, a catheter must be passed.

Passing the Catheter.—The catheter ought to be of some boilable material—rubber, silver, or glass. The glass catheter is easily cleansed and, if care is taken to make sure that it is not cracked, by careful examination and by gently tapping it on the edge of the bowl, is the best in skilled hands. The catheter is boiled and placed in lotion ready for use. The patient lying on her back separates the knees so that a good view of the vulva can be obtained, and the attendant should take some trouble to see that she has a good light and so placed that in passing the catheter she will not get in her own light. The external parts must then be cleansed with soap and water and afterwards swabbed over with antiseptic lotion. In order to avoid any lochial discharge being carried into the bladder it is well to plug the vagina with a wool swab, but care must be taken that the swab is clean and that it is not overlooked and left in the vagina. The best plan is to tie a piece of tape on a pledget of wool, boil it and place it in the bowl with the catheter. When the patient is washed up and in a suitable position as regards light, the bowl with catheter and swab are placed conveniently beside her and a receiver for the urine between her legs ; the midwife then washes her hands and soaks them in lotion and with the fingers of the left hand the labia are opened and the plug squeezed dry, pushed just inside the vagina, with the " reminder " tape hanging out ; the mouth of the urethra is looked for and recognized. It is then swabbed over and the catheter taken in the right hand and passed straight into the urethra, without touching anything, until the urine flows. Should it touch anything, bedclothes or patient's body, it must be sterilized again. When the flow of urine slackens the left hand is used to press on the abdomen above the pubes till no more urine escapes and the catheter gently withdrawn, pinching it if it is a rubber catheter or placing the finger over the end if metal or glass to prevent soiling with drops of urine. The plug is then withdrawn from the vagina. The secret of this little operation is to make sure that the urinary meatus is plainly seen before trying to pass the catheter, and when there is bruising and swelling of the parts this is not always easy. In cases of difficulty a finger should be placed within the vagina, when the urethral orifice will be recognized just above the finger.

Though the attendant should exercise much patience before resorting to the catheter, it is inadvisable to wait more than twelve hours, and if the patient is uncomfortable or there is a soft swelling—the distended bladder—to be seen or felt above the pubes, then the urine ought to be drawn off at once.

A binder has from time immemorial been looked upon as an essential for the puerperal patient, and many women find support from its use. It is by no means important, and indeed is best left off as soon as the patient ceases to feel the need of it. It does not preserve the figure, and a stiff binder used for long does positive harm, it acts like a splint to the abdomen, and the effect of a splint on a limb is well known—it causes muscular wasting of no small degree. A binder after a time will do the same and, by preventing movements of the abdominal muscles, cause wasting of these important supports of the abdominal organs. Also, in hot weather a binder is uncomfortable. The many-tailed flannel bandage used after abdominal operations makes a very good and comfortable binder, is soft and easily applied. At least two should be made so as to allow for washing.

The nipples should be washed after each nursing and the breasts, if heavy, supported by a bandage after lactation begins.

Observation of the Lying-in Mother.

The observation of the lying-in woman is very important, and the well-trained midwife will at each visit make a series of observations in order to see that everything is going on satisfactorily. She will begin by asking certain questions. How her patient has slept and how she feels ? Whether she has had much loss, has passed water, and whether she has pain or soreness, abdominal or vulval ? She will then take the pulse rate and temperature ; examine the abdomen, and note the height of the uterus and if there is any distension of the bladder ; any tenderness of the uterus or the abdomen will also be noticed. The pads will be inspected

and a note made as to the amount and character of the loss, and if there is any odour. The breasts and nipples will also be examined.

Pulse Rate and Temperature.—The pulse rate will be counted and the temperature taken. The C.M.B. Rules state : " The midwife shall take and record the pulse and temperature of the patient at each visit, entering her records, with dates and times, in a notebook or on charts, which must be carefully preserved " (E 14). For the first a watch with a second-hand is required, and the beats ought to be counted for at least half a minute, and, if the rate is rapid, for a full minute. It is advisable, especially with excitable and nervous patients, to wait a short time after arrival at the house before counting the pulse so that the excitement of the visit has subsided, but it always ought to be done before attending the patient and moving her in bed, as that also increases the heart rate.

The temperature may be taken either in the axilla or the mouth. If in the axilla, care must be taken that the bulb of the thermometer is well covered by the arm being held into the body and that full time is given before removing it. The axillary temperature is slightly lower than one taken in the mouth. After the reading of the thermometer has been noted, the mercury should be shaken down, the instrument cleansed in lotion (not hot, otherwise it will be broken) and carefully dried. When possible a chart should always be kept, but in district work where the patient is only visited occasionally this is not always possible. A morning and evening record should always be made for the first five or six days, and afterwards evening visits should alternate with morning visits so that it is known that the evening as well as the morning temperature is not raised.

In an uncomplicated case the temperature and pulse vary little from the average of 98°·4 and 72. Though slight exertion and emotion may cause a considerable rise in the pulse rate, it is very temporary, and, generally speaking, the temperature and pulse rise and fall together.

Any rise of temperature above 100° must be considered as abnormal and possibly due to septic infection (p. 239) ; the C.M.B. Rules lay down as a condition in which medical help must be obtained, " Rise of temperature above 100°·4 F. with quickening of the pulse for more than twenty-four hours." The C.M.B. for Scotland has the same rule, but with 100° F. instead of 100°·4 (E 21 (4)). This rule allows the midwife to wait twenty-four hours, because there are transient rises of temperature due to minor causes, and she is allowed this interval to see if the fever is of temporary duration.

Such transient rises may be due to the following causes :

1. *Reaction.*—In the first twenty-four hours there may be a rise even to 101° or 102°, which subsides in a few hours.

2. *Emotional.*—During the lying-in time any excitement may send up the temperature and pulse rate for a short time. Visiting day at a maternity hospital always results in a few rises of this kind. Sudden shock from bad news or a fright may send the temperature as high as 103°, and over. Such rises are of very short duration—they go up like a rocket and down like the stick—and they indicate the importance of keeping the patient free from worry and visitors.

3. *Constipation* may cause slight fever, but a good purge will soon show if this is the true explanation.

4. *Pain and tenderness of the breasts* when the milk secretion is established about the third or fourth days may cause slight fever. The breasts will be hard and knotty if this is the explanation. Cracked nipples, inflammation, and abscess of the breast may cause more serious rises of temperature.

Extensive laceration and bruising of the soft parts, inflamed piles and intercurrent diseases, such as sore throat and influenza, may also give rise to fever, but it is not the midwife's duty to diagnose such conditions. She must follow strictly the rule of the C.M.B., and in any case of fever about 100°·4 (or 100° in Scotland), lasting over twenty-four hours, obtain medical advice. The safest course for her patient is for her to presume that it is due to sepsis.

The binder, if one is worn, ought to be undone and the uterus examined and its height measured and noted. The patient should pass water before this is done, as a distended bladder draws the uterus up with it (p. 229). A footrule is better

than a tape measure, and all that is necessary is to mark with the left hand the position of the fundus and place the footrule with the 0 mark on the symphysis and note the number of inches to the hand marking the position of the fundus. If a chart is kept, the height can be jotted on it; the 100° line marks the symphysis and each degree above an inch. Thus the first dot would be somewhere between 105° and 106°, and in the course of three or four days the dot would be between 103° and 104°, and by the end of a week about 101° or 102°. By joining these dots a curved line is obtained, generally showing a slow descent at first and more rapid fall later on; such observations are particularly valuable if complications should arise. A rough and much less accurate method of observing the involution is to note how many fingers can be got between the umbilicus and the fundus. To begin with, the fundus will be about the level of the umbilicus, then one finger and later two or three finger breadths will intervene, and so on. Besides measuring the height of the fundus note should be made of any tenderness, care being taken to exclude pain from contractions started by manipulation, and tenderness of the abdominal wall resulting from manipulation during labour.

General tenderness of the abdomen, especially if accompanied by distension and symptoms of general illness, may mean serious internal inflammation (peritonitis), and therefore a doctor must be called. The lochia form another index of the process of involution, and any departure from the normal must be noticed. If the loss is excessive or bright red at the end of the week, probably something is retained and the healing process is not going on properly; medical advice should be obtained. If the pads are offensive and the smell is not due to decomposition on the pads, as shown by the fact that the discharges are themselves offensive, the C.M.B. Rules require medical advice to be obtained. The midwife must not, however, forget that the points specifically mentioned in the rules are merely instances and are governed by the necessity of obtaining medical assistance "in all cases of illness" (E 20). Therefore, her duty is to watch her patient carefully, and if any illness arises to call medical aid, whether the patient's symptoms and condition are one of the examples specified in E 21 or not.

The attention to the lying-in mother as laid down here is the absolute minimum, and in future it is probable that more nursing care will be demanded than has been customary in the past. It has been suggested that in a normal case the ordinary practice should be two visits for the first 3 days, one for each day to the 10th, and then one on the 12th and 14th; more visits and over a long period would be required if there should be any condition in mother or child to suggest further observation.

CHAPTER XXIII.

COMPLICATIONS OF THE PUERPERIUM.

A.

PUERPERAL INFECTIONS.

Once labour is over the chief danger to the woman in child-bed is that of sepsis, due to bacterial infection of the raw surface left in the interior of the uterus after the separation of the placenta and membranes, and to a lesser degree of lacerations of the cervix, vagina, and perineum. To understand this danger and the means of preventing it, the pupil is advised to read again the introductory section on bacteria and the chapter on surgical cleanliness. The various forms of blood-poisoning comprised under the old and unscientific term of puerperal fever are now known to be in no way peculiar to the lying-in woman. They are exactly the same disease as may arise from any other poisoned wound and after any wound or surgical operation in which the antiseptic precautions have failed, and in order that the midwife should fully appreciate this it will be well worth while to give a short historical sketch of the discovery of the true nature of puerperal fever.

The credit of this great discovery belongs to Semmelweiss, a Hungarian, although before his time others had called attention to these fevers being contagious, *i.e.* conveyed by touch from one patient to another.

When Semmelweiss was in charge of a large maternity hospital in Vienna, where one part was devoted to the training of midwives and the other to the training of medical students, he noticed that the death rate from puerperal fevers was much greater in the medical part than in the midwives' part, and further, that with a keen and energetic doctor, who investigated and examined his cases thoroughly, the death rate was greater than under a lazy and inefficient officer, who did as little for his patients as possible. But what particularly attracted his attention was the illness and death of a doctor from blood-poisoning, due to his infecting his hand while performing a post-mortem examination on a woman who had died of puerperal fever. The doctor's illness and the post-mortem examination showed that he had died from exactly the same disease as the woman in child-bed, and this made Semmelweiss think that puerperal fever was not a disease peculiar to the lying-in woman as had been thought, but was simply "surgical wound fever" as seen in the general hospitals, and that the cause of its greater prevalence in the medical section of the maternity hospital was that it was introduced by the medical students from cases in the general hospital and from the post-mortem room. He therefore drew up special regulations prohibiting students coming from the post-mortem room and surgical wards to examine the lying-in women, and he began the earliest system of antiseptics by ordering them to wash their hands and arms and disinfect them with chloride of lime before attending midwifery patients. These regulations completely altered the state of affairs in the hospital, and the mortality from puerperal fever dropped enormously, so that it became lower in the medical than in the midwives' section. But his medical colleagues refused to accept Semmelweiss's views and would not give up the old ideas that the disease was due to chill and bad air, and so on; more than that, they resented his ideas as proving that the doctor himself was the cause of his patient's illness and death. So like many another discoverer, Semmelweiss was treated with scorn and contempt, and being anything but an easy-going opponent, he was driven from Vienna to Budapest, where

he died a soured and disappointed man. And yet he nearly discovered the whole antiseptic system, which might thus have come from obstetrics instead of from surgery. But it must be remembered that he knew nothing of bacteria ; Pasteur's researches on various bacterial infections came later and opened the way for Lister to begin the use of carbolic acid as a germicide to disinfect hands, instruments, and wounds, and so to begin the antiseptic system which has revolutionized surgery and midwifery. Under this system and the more modern aseptic system the lying-in hospital from being the most dangerous place for a woman to be confined has become the safest. Epidemics of puerperal fever which used to lead to the shutting down of these hospitals are now rare. This freedom from infective disease can only be maintained by rigid attention to the principles of " surgical cleanliness " and watchfulness, any relaxation of which may lead to an outbreak.

Causation.

The puerperal fevers, then, are the same diseases as may occur from the invasion of the body by micro-organisms through any wound—from a prick of the finger by a dirty pin, a laceration from some accident, or an operation incision—their essential cause being the introduction into the genital tract of bacteria. Hence some carelessness on the part of the attendant and want of thoroughness in carrying out the principles of surgical cleanliness is the most common cause. If in addition there are portions of retained placenta or membranes in the uterus, so as to afford a particularly good soil for bacteria to grow in, or if there has been much bruising and laceration of the soft parts so that their resistance is lowered, the conditions will be all the more favourable to bacterial growth. Although the uterine cavity is ordinarily germ-free, the cervical canal, vagina, and the vulval and anal regions are not and cannot be made germ-free, because of folds, crevices, and minute and complex glands into which antiseptic solutions never penetrate. Hence examinations and internal manipulations are liable to result in the carrying of infection from the surface areas round the opening and from the lower reaches of the genital tract to the upper portions. Rise of temperature (morbidity) among lying-in patients is always found to be greater with internal interference and the higher up the manipulation extends, the greater the risk of infection.

If the resisting powers of the patient are diminished, owing to weakness from hæmorrhage, serious constitutional disease, alcoholism, bad hygienic conditions, etc., the bacterial invasion will be much more serious and much more likely to spread into a general infection of the whole body. The nature of the infecting organism will also make a difference in the seriousness of the disease. Some bacteria are especially virulent, so that a very minute infection will prove fatal ; and this is markedly the case when the disease-producing organism is introduced from another case of puerperal sepsis or from a case of septicæmia or pyæmia or from any acute suppurative condition. It is because of this that the C.M.B. lays down strict regulations as to the disinfection of the person, clothing, and appliances of the midwife if she has been in attendance on a case of puerperal or other infectious illness, and that this must be done to the satisfaction of the local supervising authority before attending other patients.

Generally the organisms are introduced at the labour—that is, during vaginal examination or some internal manipulation ; occasionally infection may occur during the puerperium through want of proper precautions in the washing or douching, etc., of the patient. Many of the cases in which the symptoms do not appear till near the end of the first week are infected after labour. This means, then, there must be no slackening in the precautions during the lying-in time.

Recently much attention has been paid to the possibility of air-borne infection from the air passages of attendants or, in the case of hospital wards, from other patients. Streptococci are not infrequent in the throats (tonsils) and nasal passages of those suffering from sore throats and nasal catarrh, and are occasionally found in otherwise healthy persons, who are " carriers." The woman in labour may thus be infected, either directly through the genital passages or indirectly by first having her throat or nose infected with secondary spread to the genital tract. The danger

of atmospheric pollution will obviously be greater in hospital wards with their larger number of patients and attendants to infect one another than in a private house where the patient is delivered with perhaps only one or two in attendance on her.

It is important that the midwife should have in mind this possibility and recognize that a sore throat or even a cold may be a danger to her patients, as a sore on the finger would be. It is a safe precaution even if she is not ill but has a cold in the head or sore throat to wear a mask or veil of a double fold of butter muslin to cover the mouth and nose, described on p. 134, as in common use by surgeons when operating. Also before returning to duty after a sore throat, a swab from the throat should be taken to discover if dangerous organisms are still present.

A certain small percentage of cases of puerperal sepsis occur among women who deliver themselves naturally and have had no internal examination or other interference by which infection might be caused and yet develop severe and even fatal puerperal sepsis. The infection in some of these cases is thought to be autogenous, *i.e.* arising in the patient herself, either from organisms present in the cervix or other part of the genital canal, or in her teeth, tonsils, or other focus in her body that is either carried by her fingers or by the blood stream to the genital area. It is for this reason that the discovery and treatment of all discharges, ulcers, and other septic foci forms an important part of antenatal supervision. Another possible cause of infection is sexual connection during the last two months of pregnancy, and it is as well that the risk should be explained to the husband if there is any possible chance of his receiving and acting on the advice given.

The important point in causation is that there is general agreement that the vast majority of puerperal infections are introduced into the patient from without.

The Symptoms and Signs of Puerperal Infection.

Unless in very acute infections the onset is gradual, and the first thing that will attract the midwife's attention is a rise of temperature with quickening of the pulse rate, followed by other indications of fever. The patient may feel cold and shivery, or possibly have a shivering fit, and later complain of feeling hot and dry. She will have headache with loss of appetite and thirst, and possibly be troubled with sleeplessness. The bowels are generally constipated at first and difficult to move, but later on in the illness diarrhœa, sometimes very offensive, may occur. The tongue becomes furred, and later dry and cracked, and the lips become caked with scales (sordes). Sometimes vomiting is a troublesome symptom. Jaundice is a very serious sign when it occurs, and so are many of the skin rashes, some red like a scarlatina rash ; occasionally hæmorrhagic spots which do not disappear on pressure may be seen, and they may almost be described as a death-warrant, for it is excessively rare for a patient to recover if these purpuric spots appear. Rigors followed by burning heats, and later profuse sweats, may exhaust the patient, and delirium at night occurs frequently with the more serious cases. With these general symptoms there may be definite local signs. Abdominal pain is not common, though excessive afterpains are frequent, but tenderness of the uterus and of the whole abdomen and perhaps distension may be present. The uterus is generally larger than it should be (subinvolution) and the lochia may be profuse and offensive, or may show nothing abnormal, or may be diminished or in rare cases suppressed altogether. Marked distension and tenderness of the abdomen, accompanied by vomiting, hiccough, and constipation or diarrhœa, would suggest general peritonitis.

After this general sketch the individual signs and symptoms may be considered more in detail and in relation to the particular form of puerperal infection in which they are most marked.

1. **Temperature and Pulse.**—In very severe infections the temperature may be raised on the first day of the puerperium, and it may be stated as a rough guide that the earlier and the higher the rise the more serious the infection. Commonly it is on the third or fourth day that the temperature is decidedly raised ; in the milder cases the temperature will rise in a step-like manner from about the third day. A chart of this type would show on the third day a rise to, say, 100° in the

evening, with a drop to nearly normal in the morning ; on the fourth day, an evening temperature of 102°, with a drop to 100° in the morning ; and on the fifth day, a rise to 104° or 105°, with a drop to 101° or 102° in the morning. On the other hand, the temperature may suddenly rise on the third day or thereabouts to 103° or 104°, and if a rapid rise of this kind occurs, the patient is very likely to have a shivering fit or rigor. A sudden high temperature with rigor, especially if early in the puerperium, suggests a virulent septicæmia. Sometimes there is no rise of temperature.

The pulse rate increases with the temperature, and unless the patient is suffering also from the effects of hæmorrhage or exhaustion from a prolonged and complicated labour, the beat is full and bounding and soft, *i.e.* is very easily compressed and stopped by the finger. The rate falls with the temperature, but in serious septicæmia cases it may remain well above 100 even when there are remissions of the fever. Therefore a persistently rapid pulse rate is a bad omen.

The C.M.B. Rules lay down all cases of illness of the mother (E 20) and give instances among the conditions in the puerperium for which medical help must be obtained (E 21 (4)) : **" Rigor, with raised temperature,"** and **" Rise of temperature to 100°·4** (100° C.M.B. for Scotland), **for twenty-four hours or its recurrence within that period."**

The first of these is clear ; it excludes the rigors and shiverings which occasionally follow the labour—within an hour or two—and are unaccompanied by fever. Otherwise a rigor with fever necessitates medical advice being sought at once, as these cases are generally serious ones. The second allows of a period of twenty-four hours for observation, in order that the attendant may exclude the minor causes of fever in the puerperium discussed on page 235. If, therefore, the temperature did not drop in twenty-four hours, or if it rose again, medical aid should be obtained. Also if a rise to 103° occurred, even if unaccompanied by a rigor, medical aid should be obtained at once. Fever above 103° is exceedingly unlikely to be due to any of the minor causes, and the midwife will err on the safe side if she interprets this rule in the manner suggested and obtains medical advice without waiting twenty-four hours ; also for fever between 99° and 100° persisting for two or three days.

2. **Abdominal swelling and tenderness** is another instance mentioned as requiring medical aid. This includes general distension of the abdomen due to inefficient action of the bowels, so that they become blown out and distended with wind and are not relieved by enemata or aperients. There may also be flatulence with eructations and vomiting, hiccough, and quickening of the pulse indicating peritonitis. Diarrhœa may set in, and there may be no fever, but the woman will be very ill. Abdominal swelling may also occur from other causes, the presence of a tumour or fluid, or most commonly delayed involution of the uterus, which may remain about the level of the umbilicus for a week or more, probably because there is something retained within it. Should the retained matter remain aseptic, it will give rise only to hæmorrhage or persistent redness of the lochia (in the C.M.B. Rules " secondary postpartum hæmorrhage "), but if putrefactive organisms are present, it will undergo putrefaction, giving rise to profuse and offensive lochia. In such cases the uterus is also tender, sometimes about one special spot, so that not only would the abdominal swelling and tenderness be an indication for obtaining assistance but also the offensive lochia.

3. **Offensive Lochia, if persistent.**—Offensive lochia indicates the presence of putrefactive bacteria, but possibly they may not be in the uterus, but only in the vagina or vulva or on the pads. As the discharges flow down from the uterus the bacteria may not reach the uterine cavity against the stream, and if there are no lacerations in the vulva or vagina, no absorption may take place. If there is absorption there will be fever. If the midwife notices that the pads are offensive, she should try to discover if the fresh discharges are offensive, and if they are found to be so, and there is no fever or delayed involution with tenderness of the uterus, a non-poisonous antiseptic vaginal douche such as tincture of iodine (a drachm to the pint) should be given, and careful examination made of the lochia. If the offensiveness persists, then, according to the rules, medical assistance must be obtained. Foul lochia generally mean retention of portions of placenta or membranes, with putrefactive infection, and in such cases they will also be profuse, and accompanied by

fever, delayed involution, and tenderness of the uterus ; but, and this is especially probable if the offensiveness occurs late in the puerperium, there may be little absorption and yet a septic condition of the interior of the uterus which may lead to inflammation of the Fallopian tubes and ovaries and other local troubles or possibly to " white leg " or femoral thrombosis (p. 245), which is another condition mentioned in the rules as requiring medical advice.

Before discussing the prevention and treatment of the puerperal infections it will be well to describe some variations in the type of infections which the midwife may meet, although it is not her duty to differentiate between them. First of all, a distinction has been made in the Introduction (p. 28) between *septicæmia*, in which pathogenic organisms, generally the pyogenic or pus-producing cocci, have invaded the blood stream and infected the whole body, and *sapræmia*, septic or putrid intoxication, in which the blood stream is free from organisms but is poisoned by the toxic products absorbed from the uterine cavity, where they arise from the growth of pathogenic or putrefactive bacteria on the lochia, blood clot, or retained portions of after-birth. The distinction cannot, however, be maintained nowadays for it breaks down on the bacteriological side in that in all serious infections there is a septic infection as well as a sapræmic. If the patient has been infected with pathogenic organisms, streptococci or staphylococci, the chances are against its being a pure infection ; it will probably be mixed with various common saprophytes (p. 25).

The term sapræmia is now used loosely to designate a less serious type of puerperal infection, in which the clinical signs indicate the presence of retained portions of after-birth in the uterus and their infection by both putrefactive and pyogenic organisms. At any moment it may become serious by a general spread of infection into the blood stream, and in many cases treatment by removal of the retained material produces this disaster. The operation, especially if a sharp instrument like a curette is used, is often followed by a rapid rise of temperature and a rigor, indicating a spread of organisms into the blood stream, as the result of opening up new raw areas in the uterus. Blood taken from the arm or elsewhere at the time of the rigor usually shows the presence of streptococci. The old explanation of the two types, given in the Introduction, is left, because it is not wholly abandoned by some authorities, but the real distinction is between two clinical types and may be described thus.

In cases of the sapræmic type, the fever begins later in the puerperium, often on the third or fourth day, rigors are less common, at any rate at the beginning of the illness, and there is not so much quickening of the pulse. The lochia are profuse and foul ; the uterus tender and its involution markedly delayed ; the fever, together with other effects of poisoning, produce wasting and illness.

In a pure septicæmia the temperature would rise earlier in the puerperium, on the second day probably, would be higher and therefore more likely to be accompanied by rigors, and the remissions would be less marked ; the pulse rate would be more quickened in relation to the temperature and the drop with the remissions of temperature would be less. The lochia would not be offensive, indeed they might appear normal or might be diminished in quantity, and occasionally may be even suppressed altogether. The rate of involution of the uterus is diminished, but not so markedly so as in sapræmia. The secretion of milk may be checked. The patient, though evidently very seriously ill, may feel well and think that but for headache or the burning heat of her skin she would be all right. Or the headache, sleeplessness, and fever may make her feel very ill.

Pyæmia is to be regarded as a variety of septicæmia characterized by the formation of abscesses in distant parts, lungs, joints, etc., due to the distribution of infected thrombi (blood clot) from the uterine sinuses by the blood stream. The pyæmic cases drag on for longer than the purely septicæmic type, and generally have many rigors with profuse sweating as the temperature fluctuates greatly, in a day rising to 104° or 105° and dropping again to under 100°. There may be periods when the temperature seems to drop to a lower level followed by periods of increased fever due to fresh abscess formation. In the pyæmic cases thrombosis of veins (pp. 27 and 245) with local œdema is common.

Besides these general infections it must not be forgotten that local septic troubles

in the peritoneal cavity or in the pelvis may arise with a general infection or after a puerperium which has been "morbid," *i.e.* in which there has been evidence of some slight sepsis, such as slight rises of temperature, offensive lochia, and so on. The most serious form, general peritonitis, which is usually fatal, is due to the passage of virulent organisms from the uterus to the abdominal cavity, and has already been mentioned. Much more frequently, however, the peritonitis is not general but limited to the pelvis, and in such cases an abscess may form in the pelvis or lower abdomen or in the tube or ovary. Again, as the result of infection of the thrombi in the placental sinuses, abscesses may form in the uterine wall or in the broad ligament. Abscess formation will result in the pus coming to the surface by the abdominal wall or bursting into the rectum. Or if the infection is not severe enough to cause general peritonitis, there may be *pelvic peritonitis*, local inflammation leading ultimately to closure of the Fallopian tube and adhesions in the pelvis (salpingitis) and consequent sterility of the patient. Another and much less common form is inflammation of the cellular tissue, or loose connective tissue that forms the packing round the various organs in the pelvis. This is caused by the bacterial infection of lacerations, usually of the cervix, and may also result in abscess formation, in which case the abscess opens above the groin or somewhere on the abdominal wall or upper part of the thigh. Femoral thrombosis, or white leg (p. 255), is also a consequence of infection. These local inflammations will generally follow the other signs of infection as already described, and, in any case, will be accompanied by fever and pain, and will require medical aid as soon as possible. The patient lies on her back with the leg on one or other side drawn up, and any movement of the lower part of the body causes pain. Fever arising in the second week of the puerperium is often due to local infections.

The Treatment and Management of Puerperal Infections.

Preventive Treatment.—This consists in the most scrupulous care in carrying out the methods of surgical cleanliness so as to guard against infection, in managing the labour so as to avoid the retention of any portions of the after-birth, and in continuing throughout the lying-in time the same careful precautions as during the labour. The C.M.B. regulations are very explicit. "The midwife must be scrupulously clean in every way, because the smallest particle of decomposing matter may set up puerperal fevers. She must wear a clean dress of washable material, and over it a clean washable apron," etc. (E 2).

The important thing for the midwife to realize is that unless she carries out the methods of preventing infection carefully, methodically, and intelligently, her patients will run a greater risk from her help than if they were left entirely unattended. A careless attendant is the greatest risk the lying-in woman has to face.

Although the causes of infection have already been mentioned, it may be helpful to emphasize prevention by repeating the outstanding measures in the prevention of puerperal sepsis in a way that will readily bring them to mind.

Antenatal.—Care of the woman's health to increase resistance to infection.

Treatment of discharges and other septic conditions that may be possible sources of infection.

Removal of all factors that may give rise to prolonged or complicated labour, so far as it is possible.

Natal.—Strict attention to surgical cleanliness in all directions.

Secure normal labour without internal examination or interference ; but also

Avoid long and exhausting labours with fatigue of the mother and consequent lowered powers of resistance.

Avoid all bruising and laceration, because damaged tissues have little resistance to infection.

Immediate suture of tears not prevented, to obtain rapid healing and avoid open wounds readily infected.

Careful management of the third stage to lessen the chances of retained portions of after-birth.

Postnatal.—Careful nursing continuing strict attention to surgical cleanliness,

Promote free drainage from the uterus by posture and movement in bed.

Watch carefully the involution of the uterus and any indication of delay or retention of lochia, etc.

On attendant's part.—Care of hands; avoid soiling by infective matter; report at once any cases of possible sepsis in other patients, also sore throat or other possible cause of infection in herself.

If there is any fever or any of the symptoms and signs mentioned which might indicate the commencement of puerperal infection, the midwife will at once summon medical aid, and afterwards follow implicitly the instructions of the doctor and the local supervising authority. It is scarcely necessary to explain the necessity of early diagnosis and treatment not only for the sake of her patient, but also for the sake of others she may be called on to attend. In many of these cases the chance of recovery depends so much on keeping up the patient's strength, and in this way, and on increasing her powers of resistance to the invading organisms by the methods described in the Introduction (p. 27), that some general instructions on the nursing and management of the septic fevers may be useful, though it may not be forgotten that these are general, and may be modified by individual practitioners, and that the doctor's instructions must be loyally observed if the patient is to have the best chance of recovery.

The midwife cannot undertake other midwifery work should she have charge of a septic case; there is a rule of the C.M.B. specially governing such cases. By Rule E (6) the midwife, whether acting as midwife or nurse, in attendance upon a patient or in contact with a person suffering from puerperal fevers or from any other condition supposed to be infectious, or is herself liable to be a source of infection, must at once notify the L.S.A. of the fact and be disinfected to the satisfaction of the L.S.A. before going to any other maternity patient. Also should she be recalled to a case owing to illness of the mother after ceasing attendance, the same rules apply as indicated in E 12. These instructions regarding the nursing of puerperal infections will only concern the midwife if she is retained for the time being to attend to a case of puerperal fever and gives up other maternity work.

Nursing in Puerperal Infections.

Suggestions as to preparation for and assisting at operations for evacuating and washing out the uterus will be found under "Vaginal and Perineal Operations," page 314; for the care of the patient recovering from an anæsthetic and immediately after operation, on pages 313–314.

Posture is important as it is an essential matter to promote free escape of the discharges from the uterus. The best is a sitting position with a back-rest. If the patient is not able to do this, the head of the bed should be raised. If sitting up tires the patient, it may be adopted for short periods, and the head of the bed raised when she is lying down. Frequent change of position also promotes drainage.

Throughout the illness the attendant must make her patient's comfort her constant care. Unless this is done her patient will neither sleep nor eat, two of the most important items in keeping up her strength.

Her mouth will require great attention, for with a dry and dirty tongue and scales (sordes) on the lips it is impossible for the patient to take nourishment as she should. The tongue should be wiped over with a pledget of wool or a little lint on the finger and kept as free from fur as possible; the teeth and gums should be cleansed and the mouth frequently washed out with boracic lotion or other suitable mouth wash. Lemon and glycerine to the tongue and lips is often useful.

A rigor is very distressing to the patient and is often accompanied by marked collapse. As soon as the patient begins to feel cold and shivery, she should be given hot bottles, and extra blankets and rugs put over her. A rubber bag with hot water over the chest is often a comfort, and so is brandy or whisky in hot water or other hot drink. After the rigor the patient may feel hot and burning, so the extra coverings are best removed and she can have as much fluid as she likes to drink. When the temperature falls rapidly profuse sweating often accompanies it, and this frequently happens during the night—in the early morning hours. The

patient will wake up wet and uncomfortable and will not sleep again unless she is made comfortable. Her night-gown should be changed and bed linen too if need be, or she should be moved on to another part of her bed and the body should be carefully dried. Very often she will be made comfortable by sponging over with tepid water to which a little vinegar, ammonia, or eau-de-Cologne has been added, and will go to sleep at once when she has been put into dry things. Care must be taken to avoid chilling, but the room must be kept well aired and ventilated, and no harm will come from frequent opening of the windows so long as the patient is well covered. Nothing increases the patient's powers of resistance more than fresh air and sunshine ; they give a feeling of well-being, increase the appetite, and help sleep. So with the consent of the medical attendant, the midwife should use her ingenuity to make the most of the conditions in the patient's home to obtain these greatest of nature's medicines. The patient may be moved to the sunniest and airiest room in the house and her bed placed near the sunniest window. If the patient is kept warm by hot bottles and wraps it may be possible for her to lie all day by an open window. The chief problem is keeping the patient warm during cold weather ; some judgment is required as to how this can be done, and the co-operation of the relatives and friends in changing hot bottles and so on in the absence of the attendant will be necessary.

The question of feeding is of the utmost importance, and here the nurse must be guided by the doctor's instructions. It may, however, be stated that in these cases there is not the same need of limitation in diet, as for instance in typhoid fever, where there is actual disease of the digestive canal. The patient can have any easily digestible nutritious food she may fancy, though what she can and what she cannot digest will depend on the fever and the condition of her tongue and digestive tract. Milk and milk foods, such as junket, arrowroot, and patent foods, custards, and so on, with broths and soups and beaten-up egg will probably be the staple, and when the temperature is high will be all she can profitably take. If the nurse watches her opportunity to feed her patient when the temperature is low, she will often find that fish and chicken and lightly cooked meat may be taken in small quantities. In cases, for instance, in which the temperature is lowest in the mornings, it may be that a considerable selection is possible then, whilst in the evening and at night milk and milk foods only are possible. The more fluid the patient can take the better ; if there is profuse sweating, fluid is required to make up the wastage, and in any case fluid forms a means of flushing the body and getting rid of toxic matter. Alcohol in some form may be ordered, and the nurse must give it according to instructions.

To reduce the fever tepid or cold sponging or cold packs may be ordered. The patient should be covered with a blanket and only exposed so far as need be for the part being sponged ; a basin of water with a little ammonia in it is placed by the bedside and the body and limbs sponged thoroughly, first the front and then the back, and afterwards dried. A warm, dry night-gown is put on and the patient left to sleep. If a cold sponging has been given, there may be some depression ; in these cases the temperature of the patient should be observed, and when it has fallen 4° or so, the sponging should cease. Some stimulant may be required. If the patient is delirious a hot pack (p. 304) may be ordered.

The bowels will probably be kept active by purgatives, but enemata may be ordered ; and as in some cases a severe form of diarrhœa occurs, a careful watch must be kept on the effect of the medicine used. Should diarrhœa occur, special care is required in keeping the patient clean, all the more if she is delirious, or if the bowels act without her knowledge. Bed-sores are quickly formed in such cases, as the motions are very irritating to the skin. The same holds good for the passage of urine ; should this occur involuntarily, the patient must be watched and be seen to at once. Retention of urine is unusual, but again a watch must be kept above the symphysis for evidence of distended bladder. It is most likely to occur in cases with local pelvic inflammation.

If there is pain from local inflammation, fomentations and turpentine stupes may be required ; a piece of household flannel is the best for the purpose—it should be wrung dry out of almost boiling water—with a tablespoonful of turpentine to the

pint if ordered—folded and placed between two pieces of dry flannel and covered with a hot-water bag. It must be watched carefully to see that it does not blister. Hot douching may be ordered, and in this case the temperature should be as near 115° as the patient can bear ; it should be given as hot as the patient can stand and given slowly, so that the heat may have as long as possible to act.

The nurse must take every precaution against the formation of bed-sores. The patient so far as possible ought to be made to change her position, and by turning her on her sides relieve the pressure on the sacrum. It may be better for her to lie on a blanket if a water-pillow is not procurable. Any parts which show signs of pressure should be bathed and dried thoroughly and powdered with starch or zinc and boracic acid. If there is much sweating or diarrhœa, zinc ointment ought to be rubbed well into the skin.

If the patient lies with the leg drawn up or in any position of greatest ease to herself, it must not be forgotten that all joints ought to be moved at least once a day to prevent stiffness. A hand should be placed under the thigh to support it, and taking the foot in the other hand the leg should be moved up and down several times : this prevents stiffness of the knee. The hip also ought to be moved, though it is not so liable to stiffness as the knee.

The attendant on these septic cases must not forget the care of herself, and especially her hands ; any scratch or cut may be infected, so the hands ought to be anointed frequently with some antiseptic ointment and rubber gloves worn in doing dressings or any manipulation where they may come in contact with foul discharges.

The final word to those attending such cases is to advise that careful note be made of everything that happens to the patient, of the amount of sleep and of the food taken.

B.

OTHER PUERPERAL COMPLICATIONS.

Femoral Thrombosis, White Leg, or Phlegmasia alba dolens.

This condition, in which the leg becomes swollen from thrombosis or plugging by blood clot of its chief vein, is one about which there is some difficulty in deciding under what heading it ought to be classified and exactly what is meant by the various terms.

The condition formerly described as white leg, or phlegmasia alba dolens, is very rarely seen nowadays ; it was a septic infection starting by the formation of clots in the uterine sinuses and veins and spreading from the veins in the pelvis to those of the thigh and leg, thus blocking the principal vessel by which the blood is returned from the leg to the body and so causing great dropsical swelling or œdema of the whole limb, and with this also was a lymphatic obstruction, thus further increasing the escape of fluid so that a very tense hard swelling was produced. The leg became ivory white—like a " bladder of lard "—and hence the name " white leg." It came on late in the puerperium, generally in the second week, in cases in which there had been some septic trouble, and was accompanied by fever and great pain in the affected limb. When the swelling first commenced it would pit on pressure with the finger, but when fully developed the swelling was too hard to allow of the finger being pressed into it and so showed no pitting on pressure. After two or three weeks, when the swelling began to disappear, it softened and would again show pitting on pressure. The condition was a very serious one and was often accompanied by pyæmia or by suppuration in the leg, and was sometimes even followed by gangrene or death of the part owing to a complete stoppage of the circulation. It is so rare nowadays that even in the largest hospitals a case of this combined lymphatic and venous obstruction might not be seen for ten years or more. Thus the names " white leg " and " phlegmasia alba dolens " are better dropped altogether for that of " femoral thrombosis," which is a condition frequently met with.

In the majority of cases femoral thrombosis occurs when there has been some

infection or other complication, and it is not easy to say why it should occur specially in the veins of the leg. It occurs there in many diseases quite apart from childbed illnesses. Typhoid fever, for instance, and rheumatic fever, various blood diseases, and operations on the pelvic organs may be followed by femoral thrombosis. It is likely to occur not only in infected patients but also in those who are anæmic from excessive loss of blood and in those suffering from albuminuria and kidney disease.

It generally comes on about the tenth day or later, though occasionally as early as the fifth, and may begin in any portion of the vein, thus showing that it cannot be due to direct extension of blood clot from the uterine veins.

The course of the blood back from the leg and foot to the body is briefly as follows. The two chief veins from the foot run round the back of the ankle and up the leg in the thickness of the calf nearly to the knee, where they join into one big vein—the femoral vein. This vein runs up in the bend of the knee to the deep part of the back of thigh, where it passes forwards in the fleshy part to the front and runs up in the inner side of the thigh, to pass into the body somewhat to the inner side of the middle of the groin. Clotting may occur anywhere in this vein from the groin to the ankle, the commonest places being in the upper part of the thigh just below the groin, behind the knee, or in the depth of the calf of the leg. It is more common in the left leg than the right.

The condition will be readily recognized. The patient will either have had fever or some septic trouble following the labour, or she will have suffered from ante- or postpartum bleeding, or will have some serious constitutional disease. Her first complaint will be of pain somewhere in the leg—the groin, the thigh, behind the knee, or the calf—and there will be tenderness there to pressure.

With the pain there will probably be some rise of temperature—to 100° or 101°, or in bad cases even higher than this. Very soon dropsical swelling will be noticed ; commonly this begins below in the parts farthest from the body. Hence the swelling should be looked for on the front of the foot, behind the ankle, and over the shin bone. The side of the foot and leg which lies on the bed—generally the outer side—will show it first, being the lowest part, and therefore the leg ought to be turned over so as to expose the part lying on the bed. Those parts should be tested for œdema by pressing the finger in for a few seconds and then seeing if a hollow mark is left where the fluid has been pressed out. The loose skin over the shin bone is a good place to try this : if the finger is pressed down on the shin, any slight œdema of the part will be shown by the " pitting " left. When the œdema is well marked the swelling of the leg can be seen, and if the whole limb is affected it may involve the thigh right up to the groin. In such cases if the girth of the limb is taken with a tape measure it will be found to be an inch or two greater than that of the corresponding part of the other side. Sometimes the clot in the vein can be felt as a hard cord in those places where the vein is near the surface—on the inner side of the upper part of the thigh and behind the bend of the knee.

As soon as the condition is recognized the midwife will advise that a doctor be summoned. " White leg " is mentioned in the C.M.B. Rules as one of the complications of the lying-in time in which this is necessary. Before the patient is seen by the doctor the midwife must keep her quiet in bed with the affected leg between two pillows bound together over the limb so as to prevent movement. The immediate danger to the patient is that a fragment of soft clot may be detached from the vein and be carried to the heart and lungs and cause sudden death by pulmonary embolism. For this same reason, in nursing these cases great care must be taken to limit the movement of the leg during washing and attending to the patient. The medical attendant will decide on the treatment ; sometimes wool is wrapped round the limb and it is raised on pillows to facilitate the return of blood to the body, or it may be placed between sandbags to limit movement. If fomentations or dressings are ordered, a " cradle " ought to be used to allow of easy changing.

The patient will probably have to remain in bed for a month, or six weeks—till all tenderness and swelling has disappeared, but probably for long afterwards her foot will swell when she goes about.

Pulmonary Embolism and Sudden Death.

The detachment of a clot from the uterine sinuses or a thrombosed vein may result in the loose clot being carried to the heart and from there to lungs, where it will block one of the branches of the pulmonary artery. Should it be a large branch, death is immediate; if a small branch, the patient will have severe pain over the heart or in the chest, coming on with extreme suddenness and without warning, and will have great difficulty and pain in breathing (dyspnœa), with feeble pulse and all the signs of grave collapse. If death does not occur, the rapid shallow breathing continues and the face becomes cyanosed; there is much distress, with a feeling of impending death. If the clot is small, the patient may recover; in that case she will have a cough with blood-stained expectoration for a few days and a pain like pleurisy in the side, but the breathing will gradually become deeper and the cyanosis disappear.

This terrible accident may occur at the end of labour, especially if it has been complicated by hæmorrhage, or during the puerperium, but is happily rare. All patients suffering from loss of blood after ante- or postpartum hæmorrhage, and especially so long as the pulse remains rapid, should be nursed carefully. They should be kept quiet in bed and not allowed to move much; great care should be taken in lifting and moving them, and they should not be allowed to exert themselves in any way.

Should an attack of this kind occur and not prove immediately fatal, the patient should be supported in bed; as these patients cannot lie down, but must sit up because of the extreme distress in breathing, some means should be adopted to meet this. A bedroom chair turned upside down with pillows against its back will form a suitable support for the patient to lie against whilst waiting for the doctor. Stimulants, such as brandy and water or ether and ammonia, may be given, and hot bottles be placed round her, and once she is well covered the window should be opened to admit fresh air.

Other causes of sudden death during labour or the puerperium are heart failure, in patients with heart disease or after severe hæmorrhage; apoplectic stroke (hæmorrhage into the brain), most likely to occur in women with kidney disease; air embolism, due to the entrance of air into the placental sinuses (rare).

Mental Disease—Puerperal Insanity.

Sometimes excitable patients will lose control of themselves during labour, and for a time may become maniacal and not fully responsible for their actions; but it is very rare to see true insanity till a few days after labour, and most cases develop later than that. It is the cases which arise during the first fortnight while the midwife is in charge that concern us, and it is very important that the midwife should obtain assistance at the first sign of mental disease, as the woman may do harm to herself or her baby. There is no mention made of this complication in the rules of the C.M.B., but every midwife and nurse in attendance on lying-in patients should bear in mind the possibility of its occurrence. There are two types of mental disease commonly described as affecting the lying-in mother—mania and melancholia. Mania is the noisy, violent type which may arise acutely so that the patient has to be put under control at once; melancholia is the morose, depressed type which usually comes on much more gradually. Melancholia is said to be more common as the "lactation" insanity coming on in nursing mothers three months or more after labour and therefore long after the midwife has ceased attendance. These distinctions are, however, of little importance to the midwife; on the other hand, the warning signs of mental disturbance are of the greatest importance.

First of all—what patients are particularly liable to mental trouble? Those in whom it has occurred in previous confinements; occasionally patients will become insane after each confinement. If the midwife knows that a woman has had puerperal insanity, she ought to advise her to consult a medical practitioner before undertaking the case and be on her guard so long as she is in attendance. Ill-fed, ill-nourished women with many family worries and troubles, women who have had

many children in quick succession and exhausted themselves with long suckling, single girls who have suffered much mental distress throughout their pregnancy, and alcoholic women are all likely subjects. Many complications of pregnancy, labour, and lying-in predispose to insanity. Exhausting antepartum bleeding, any serious hæmorrhage, puerperal septic infections, albuminuria or renal disease, and, most of all, eclampsia, may be mentioned as predisposing causes.

Very often in consequence of some of these conditions a doctor will already have seen the patient, or there may be some fever or other reason for her being under medical care at the time, but in any case the midwife must report at once any premonitory symptoms of a mental breakdown. Sleeplessness, headache, and distaste for food are generally present, but the most ominous sign is delusion—the hearing of voices or hallucinations, seeing things which the attendant knows to be impossible.

The delusions are frequently those of persecution ; the patient thinks some one is trying to poison her or her baby, or seeking in some other way to do her harm, becomes very suspicious, and perhaps takes a strange dislike to her husband, children, or attendant. She may be very secretive about her suspicions and from being bright and talkative become very reserved, or from being quiet she may become noisy and talkative. A marked change in temperament is thus a serious sign.

If the midwife finds any reason to suspect commencing insanity, she should at once have a doctor summoned, and meantime have the baby taken away from the mother and keep a close watch on her patient until the responsibility of deciding what is to be done is on other shoulders. Without warning these poor women may jump out of the window or destroy their child, and as they are very cunning they are not easily controlled at home. Under suitable treatment most of them recover, but till they are under proper control they are a great anxiety.

Cystitis or Inflammation of the Bladder.

Cystitis is caused by organisms obtaining access to the interior of the bladder. In consequence of this, fermentation and putrefaction of the contained urine is set up, causing ammoniacal changes in it so that it becomes very irritating to the bladder wall. The bladder becomes inflamed and very sensitive and will not bear any distension. The condition is a serious one, as the infection may pass up the ducts (the ureters) to the kidney and there cause suppuration. The usual method of infection of the bladder by organisms is through a dirty catheter, and for this reason the precautions described under passing the catheter (p. 234) must be rigidly adhered to. The chief symptoms of this disease are great frequency in emptying the bladder and the passage of small quantities of thick offensive urine. The inflammation of its walls causes an insistent desire to empty the bladder as soon as a small quantity of urine collects in it, so that the patient will pass urine very frequently, perhaps every hour or two, or in bad cases even every half-hour. The urine is alkaline from the ammonia it contains and is offensive. It is thick with pus and mucous secretion from the inflamed bladder mucous membrane, and has a characteristic ammoniacal odour. If two test-tubes are taken, one half-filled with urine and the other with caustic soda solution, and then the two mixed and the mixture poured from one tube to the other, if pus is present it will become gelatinous and semi-solid, sometimes to a degree preventing the fluid being poured. Also the ammonia smell will be greatly exaggerated. There will be tenderness over the pubes, pain on passing water (from contraction of the inflamed bladder wall), and slight fever from absorption of toxins. If the infection spreads to the kidneys, irregular rises of temperature will occur and the chart will gradually appear like that of a patient with pyæmia.

Medical advice is required for these cases. The patient must be given plenty of fluid to flush out the bladder and some urinary antiseptic ; in the more severe cases the bladder may require to be irrigated with some antiseptic solution.

Breast Complications.

1. **Nipples.**—When the nipples are flattened and do not stand out sufficiently to allow the child to catch hold of them, they will lead to difficulty in, and perhaps

impossibility of, suckling. The condition is termed "*retracted nipples*," and in very bad cases the top of the nipple may be sunk below the surface of the breast in an umbilicus-like depression. This condition is largely due to faulty development, but it may be made worse by the nipples being pressed back by corsets.

The midwife ought to investigate the breasts and nipples when engaged to attend her patient, so that she may advise her as to their care and management during pregnancy. She should see that there is no injurious pressure from corsets and clothing, and if the nipples are depressed the expectant mother ought to be instructed to pull them out daily ; by patiently persevering in manipulations directed towards making them stand out, much may be accomplished. If the condition is present after labour, similar efforts may be made, care being taken to avoid injury to the tender skin of the nipple by exercising great gentleness and by using some emollient like lanoline ; the use of a nipple shield for a time may result in the drawing out of the nipple, or a breast pump may be used. If trouble is taken it will be very rarely found that nursing is impossible merely on account of retracted nipples. Patience with the infant will nearly always succeed in the drawing out of even the most unpromising nipples ; sucking by the child often proves the best remedy for retracted nipples.

Sore nipples are another trouble, for not only do they cause pain to the mother but may be a channel of infection of the breast. Retracted and badly formed nipples are especially liable to become sore from the child's efforts to catch hold of them. The skin covering the nipple is delicate and easily injured by a strong child pulling and dragging on it. This is most likely to occur if the amount of milk is insufficient to satisfy the child, so that it strains the nipple in vain efforts to extract more from it ; the same thing will occur if the child is allowed to suckle after the breast is empty or before it has filled up again—suckling too long and too often. Allowing the infant to fall asleep with the nipple in its mouth, or not supporting it properly so that it drags on the nipple, or holding it so that its nose is against the breast, thus causing it to drop the nipple repeatedly to breathe, will all have a like effect. Want of cleanliness is a common provoking cause of cracked nipples. If the nipple is not cleansed and dried after nursing, the moisture remaining on the nipple undergoes fermentation, softening and irritating the surface so that it will crack on very slight provocation, and crusts forming on the nipple cause small raw areas when they come off. Should the child's mouth be infected with thrush, or be unhealthy in any way, there is all the more chance of trouble. When a sore nipple is examined it may be found to be fissured or perhaps a small sore may be seen near its point. There is most traction on the base of the nipple, and cracks are more common there.

Sore nipples must not be neglected. Not only do they cause the mother pain, but they may bleed and the child may swallow the blood and afterwards vomit it or pass dark motions (melæna), and thus cause needless alarm. Also they are a source of danger, as through the cracks micro-organisms may obtain entrance to the breast tissue and cause inflammation and abscess.

The treatment of sore nipples must be considered under preventive measures and curative treatment. Preventive measures consist first in the preparation of the nipples during pregnancy, by avoiding injurious pressure and treating retraction, and washing and softening them in the later months with lanoline or other suitable ointment (p. 77) ; secondly, in avoiding any of the causes mentioned above as likely to provoke cracked nipples, seeing that the child is held properly during nursing and is not allowed to be too long at, or to go too frequently to, the breast, and, most of all, by strict attention to the cleansing of the nipple.

The curative treatment is to apply some antiseptic after each nursing and so far as possible avoid disturbing the nipple and allow time for healing. The simplest thing as soon as a crack is noticed is to apply a little gauze or wool soaked in 1 in 1000 perchloride of mercury solution to the nipple, washing it carefully each time before the baby is put to the breast. The slight cases will heal under this treatment. If nursing makes the nipple bleed, a nipple shield should be used for a few days, the result being carefully watched, as the suction on the nipple may still draw blood. If it does, an effort must be made to rest the breast by not using it for a day or so, and massaging it gently but firmly to squeeze out the milk which fills the breast and makes

it swollen and painful. Fomentations may help to relieve the distension. This may be continued for a day or two and the sore touched with a caustic (solid silver nitrate) pencil or painted with Friar's balsam. If the midwife does not succeed with these simple methods of treatment, a doctor should be consulted, as she ought not on her own responsibility to allow the mother to give up nursing her baby, and must notify the L.S.A. in accordance with the regulations (C.M.B. Rules, E (12A) and p. 325).

2. **Breasts.** — *Engorged* or *"Caked" Breasts.* — When the secretion of milk begins, the lobules of the breast gland sometimes become distended with milk because it is not drawn off fast enough, or because the milk ducts to the nipple are not clear. In the latter case some parts of the breast may become hard and lumpy, while the rest of the gland is quite soft, because the ducts from that part only are blocked. After the child has emptied the breast, the attendant should press the gland with the flat of the hand against the chest wall to notice whether any hard lumps can be felt. In cases in which the infant is not being nursed, the whole breast will become engorged and hard. The mother will complain of pain and heaviness of the breasts, and if the engorgement is sufficient to cause much hardness of the breast, her temperature may rise a few degrees. Where only one or two lobules are affected, there will be pain and tenderness confined to that part.

TREATMENT.—Sometimes it will be found that the only part of the breast affected is the lowest and most dependent part; in cases in which the breasts hang down, a supporting bandage will be all that is required. If there is pain, hot fomentations are a great relief. If the child is not emptying the breasts, a breast pump will draw off the excess. Firm massage, by the fingers working from the outside towards the nipples, is the best method of relieving the engorgement, especially when only a portion of the breast is affected.

Abscess of the breast is always the result of infection by micro-organisms, which may obtain entrance either through the milk ducts or through cracks in the nipple or be carried there by the blood stream. In the latter case they may find a suitable soil in a hard distended lobule, and this may, therefore, soften and break down into an abscess. This variety is more likely to arise early in the puerperium, especially if there has been some puerperal infection. The abscesses caused by infection through the ducts or from sore nipples are more common later on, and after the woman has passed from the care of the midwife. They are more common in anæmic, under-fed women, whose powers of resistance have been lowered by long nursing. Want of cleanliness and care of the nipples is a provoking cause.

There is great pain and tenderness of the breast with fever and a feeling of illness. The glands in the armpit become swollen and tender, and if the matter is coming to the surface, the skin becomes swollen, red, and shiny, and a soft spot can be felt where it is pointing. Medical assistance must be obtained as soon as there is any reason to suspect inflammation or suppuration from the presence of any of these signs. If the breast is neglected and the suppuration extends, it will destroy much of the tissue of the breast. Till the doctor sees it fomentations as hot as the patient can bear are to be applied. The regulations of the C.M.B. on breast troubles are somewhat vague; medical assistance is to be called in for "unusual swelling of the breasts with local tenderness or pain." The midwife's best plan is to get advice when the simple methods of treatment do not succeed quickly.

Management of the Breasts when the Child is Dead.—Little need be done under these circumstances. If the breasts are left alone secretion will cease, and any active measures that are tried make little difference.

A wool compress over the breasts and a firm binder so that the breasts are pressed between it and the chest wall will diminish the circulation slightly and so the secretion. The bandage should be kept tight, being tightened again if it becomes loose, and even if the breasts become painful it is best to leave it, as the discomfort does not last long. It is the general rule to allow as little as possible to drink and to obtain watery evacuations of the bowels by means of Epsom salts. It is inadvisable to draw off the milk with a breast pump, as that encourages secretion in the breasts. By exercising patience the period of discomfort is greatly shortened.

PART VI.—THE INFANT.

CHAPTER XXIV.

PHYSIOLOGY AND HYGIENE.

Physiology.

The transformation from fœtus to child in the crisis of birth is no less startling than that by which the chrysalis becomes the butterfly. Within the uterus the fœtus is kept at a uniform temperature, and protected from shocks and jars by its waterbed of liquor amnii (p. 66), and its respiratory, nutritive, and excretory functions are performed for it by the mother through the medium of the placenta (p. 63). With the plunge from its cosy quarters into a cold and cheerless world there comes, almost in the twinkling of an eye, the heavy responsibility of the maintenance of an independent existence. No longer a fœtus, the child must forthwith find its own oxygen from the air it breathes, maintain its own body-warmth, use its own excretory apparatus to get rid of its waste products, and set to work to learn to suck its food from its mother and digest and assimilate it.

The circulation has been at work throughout the fœtal stage, and the other machinery for the independent existence of the child is ready to start into action as soon as the appropriate stimulus is applied. An account is given elsewhere (p. 284) of the stimuli which provoke the first cry or breath, thus inflating the lungs, so that they can accommodate more blood than in the collapsed state. This expansion of the lungs brings about an alteration in the mechanics of the circulation; the blood stream now follows the easier route through the pulmonary arteries, and leaves the long and more difficult fœtal route by the ductus arteriosus to the aorta and umbilical arteries, as shown by the gradual cessation of pulsation in the cord. The blood oxygenated in the lungs instead of in the placenta, returns by the pulmonary veins to the left side of the heart to be distributed over the body, and, with the establishment of pulmonary respiration, any blueness which may have occurred in consequence of interference with placental respiration in the final stages of labour, gives place to the healthy pink colour of the newborn babe. The little engine is now started, and the more gently it is driven at first, and the more gradually it is allowed to run itself in, the smoother and more efficiently will it work. It is essential that those who have the care of the infant in the early days and weeks of its life, should have a clear understanding of the means by which its natural functions are brought into action, and how they should behave so that slight disturbances may be observed, and care taken to check them at the earliest possible moment. The object of this chapter, therefore, will be to describe the development of the physiological processes of the newborn infant along similar lines to those followed in the sketch of physiology outlined in the Introduction.

General Characteristics.—The full-time infant measures about 20 inches from vertex to heel, and weighs about 7 lb., but considerable variations in these figures are met with. The length is more constant than the weight, and is taken as the more accurate guide when there is a question of prematurity (p. 280). In normal infants at term the weight may vary between 5 and 12 lb. The weight gives a rough index of the strength and vitality of the child; and, other considerations being equal, it may be taken as a rough working rule, that a weight of less than 5 lb. indicates immaturity and feebleness, whilst a weight of 7 lb. and over indicates strength and vitality. A weight over 9 lb., especially if the first child, has grave disadvantages,

as the risk of injury from delay and difficulty in birth is considerable. A weight above 10 lb. suggests postmaturity, *i.e.* that the fœtus has been retained in the uterus for longer than the average duration of pregnancy, and investigation may show that the birth is some weeks after the calculated date. A well-developed child has a plump appearance, due to the thick layer of fat beneath the skin. The body and limbs are well rounded, the neck short and fat, and the cheeks full. This layer of subcutaneous fat often forms rolls about the neck and wrists, and its absence is evidence of poor nutrition or prematurity, and of the necessity for special care in management, particularly to avoid exposure and to minimize the loss of body heat.

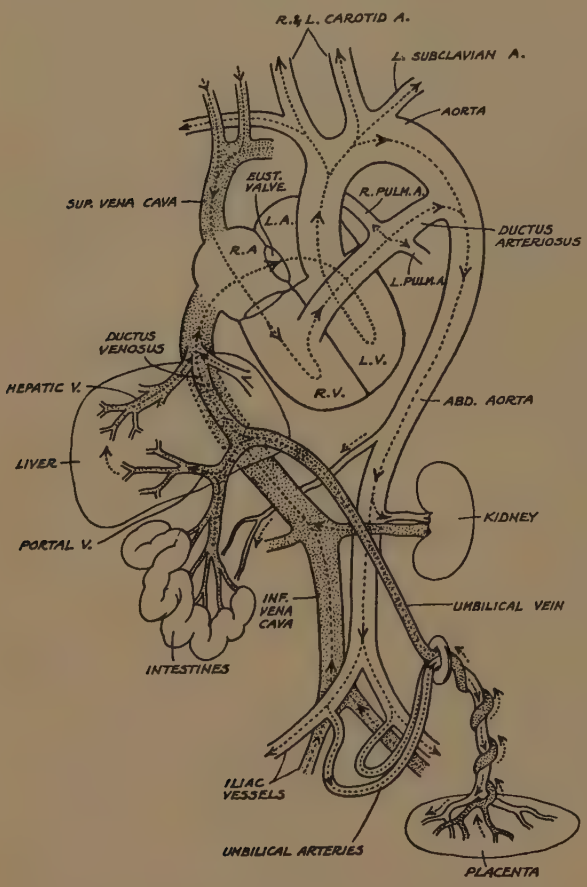

FIG. 108.—DIAGRAM OF THE FŒTAL CIRCULATION.

R.A. and *L.A.*—Right and Left Auricles.
R.V. and *L.V.*—Right and Left Ventricles.
Course of blood stream marked by arrows.
Venous system stippled, arterial plain.

Note admixture of arterial and venous blood throughout the circulatory system. The ductus arteriosus and venosus are the two fœtal bypasses that close after birth.

The bones are not so fully ossified as in the adult, and in the case of injury, separation of the growing end (epiphysis) from the shaft or bending (green-stick fracture) rather than a complete break is more likely to occur. The incomplete ossification of the membranous bones of the vault of the skull allows of moulding during birth, and in the case of the postmature infant the less yielding character of the skull is, in addition to its increased size, a further cause of difficulty in labour. After a protracted labour the head may be considerably deformed by the moulding which has occurred, but usually in a few days recovers its shape. After an easy delivery, especially in babies born by the breech, the head shows the normal rounded shape with little deformity. There is a gap in the bones at the site of the anterior fontanelle which is not completely closed up till the child is about fifteen months old. Normally, however, the floor of the fontanelle is flush with the rest of the scalp; in cases of serious malnutrition, especially if there has been much loss of fluid from vomiting and diarrhœa, the fontanelle may be depressed below the surface of the scalp, and in cases of increased intracranial pressure, as from hydrocephalus, it may be raised above the surface.

The muscles of the limbs are firm and of good tone, and move actively from birth. The muscles of the trunk also should be firm; hernia (rupture) is due to failure of the abdominal muscles to resist an increased intra-abdominal pressure.

At birth the skin is covered with a greasy substance, the vernix caseosa, composed of the secretion of its sebaceous glands together with the débris of scales of shed epithelium. When the vernix is removed, the skin is pinkish in colour, though often brighter red over the soles of the feet and palms of the hands, where peeling is also more marked during the early weeks of life. Small red blotches, which soon

disappear, are frequent about the mouth, nose, eyelids, and forehead, and should not be confused with the bright red-stained areas forming a "mother's mark" or nævus, which are permanent. Various small red spots and papules, due to the blocking of the ducts of the glands in the skin, are mentioned elsewhere (p. 297). Fine downy hair (lanugo) is usually an indication of prematurity. Generally the scalp is covered with a thick crop of longer hair, which, however, is usually shed in the first month or two of life. The nails reach beyond the finger tips, and are brittle, so that the projecting ends readily break off.

Circulatory System.—The changes in the circulation consequent on birth have already been mentioned (Fig. 108). The blood of the newborn infant contains a somewhat higher proportion of red corpuscles than in the adult, and among them occasionally may be found some of the fœtal nucleated type. This higher percentage of red cells is probably one of the factors determining the rosy pink colour of the newborn infant. The heart-beat varies from 120 to 140 per minute, and may be somewhat irregular for the first few hours after birth. The rate is usually quicker in small and premature infants, and slower with big and strong babies. The colour of the infant is a very important index of the activity of the circulation and the efficient working of the lungs. Blueness of the lips and face may be due to weakness of the action of the heart, or to incomplete expansion of the lungs. In rare cases persistent blueness may be due to malformation of the heart, such as incomplete closure of the division between the two auricles. Blueness and coldness of the hands and feet are an indication of defective vasomotor regulation (pp. 8–9) and inadequate distribution of the blood supply, to which further reference will be made later under heat-regulation.

Respiratory System.—Respiration at birth is much more rapid than later on; sometimes the rate is over 40 to the minute, is irregular, rapid alternating with slow respiration with long pauses, and is chiefly carried on by the diaphragm and abdominal muscles. A good strong cry indicates good lung expansion, whilst a feeble whine is a sign of feebleness and poor air-entry. A good cry at birth is always a pleasing sound to the attendant's ear for it means that the lungs are well blown out, and that the child has the power to do so effectively. A feeble cry, particularly if accompanied by cyanosis, is a sign of dangerous feebleness in the infant, for which medical advice is necessary, and will be discussed later in the chapter on Asphyxia (p. 290). Persistence of these symptoms may be due to incomplete expansion of the lungs, pneumonia from matter inhaled into the lungs, or to serious weakness of the heart.

Digestive System.—The lining of the mouth is pale and moist, and early exhibits the changes due to circulatory, respiratory, and other disturbances. Pallor and cyanosis are readily recognized in the lips and mouth. Dryness and a deeper red may be noticed in febrile illnesses.

The tongue has a very small tip, so that it projects relatively less beyond the frenum than is the case in older children, thus giving rise to the frequent diagnosis of "tongue-tie" (p. 292) by the ignorant and untrained. The act of sucking is readily excited by anything placed within the lips, and care must be taken in early life that this reflex is not over-excited by the sucking of the fingers or a "dummy," so that a habit is established which results in the child crying and becoming restless if the habit is checked. Swallowing is similarly excited by the presence of fluid in the mouth, and the food is passed down the gullet by peristaltic contraction. The stomach is small, but varies with the size of the infant; in a baby of 7 lb. weight it will contain little more than one ounce. This anatomical fact has been used as an argument for limiting the amount taken at a meal to the average capacity of the stomach as found on post-mortem examination. This, however, takes no notice of the physiology of the infantile stomach. Examination by X-rays after a meal in which bismuth has been mixed with the milk, shows that the food is rapidly passed out of the stomach into the small intestine, and it is found by test-weighing that a baby of a few weeks old may take 4 or even 5 ounces at a meal without disturbance, showing that food is passed out of the stomach soon after it is taken in. It is, however, very important that the capacity of the stomach is not taxed in the early days of life before the digestive and peristaltic functions of the stomach are fully

developed. Over-distension gives rise to regurgitation and vomiting, and this may readily become a serious habit, excited by very slight provocation.

Nature intended the newborn infant to subsist for the first two or three days of life on nothing more than the small quantity of colostrum obtained from the breast. The giving of feeds of milk and water or other supplementary food is not only unphysiological, but may be harmful by producing a disturbed action of the stomach. The digestive machinery should be tested with colostrum first, and then by the mother's milk, and all other foreign substances prohibited, unless failure of lactation beyond the third day necessitates supplementary feeding, in regard to which precise instructions are given later (p. 266). In the stomach the milk is coagulated by the rennin ferment, but the curd formed is much finer than the firm, hard curd of cow's milk; the powdery nature of the curd of breast milk allows of its rapid passage from the stomach into the intestine, where the chief part of the digestion occurs. A disturbed function of the stomach may be set up by too large quantities of food being given at first, and especially if it is not the infant's natural food, but cow's milk or other food of different characteristics to breast milk. Both the digestive functions of the stomach and the ordered muscular action by which its contents are moved on, may readily become disordered by mistakes in feeding during the first few days of life, and a bad habit once established is difficult to correct.

The bowels at birth contain a greenish or brownish-black treacly matter, the meconium, made up of mucus and débris of cells from the intestines, together with bile and other secretion from the digestive canal. It is the presence of old bile which gives it its dark colour. It takes three or four days for the meconium to disappear and give place to the yellow custard-like motions of the suckling infant.

The processes of digestion and absorption in the infantile intestines proceed as described in the Introduction (p. 15); the proteins—both of the curd and the soluble whey-proteins—being converted into peptones before absorption; the soluble sugar being absorbed as such, as also is the fat, already in a state of fine division, after further emulsification. The chief point of difference in the physiological processes of the infant is the inability to convert starchy matters into sugar, and thus the impossibility of making use of them as food, because insoluble starchy material cannot be absorbed till converted into soluble sugar. The less formed character of the stools is due to the fluid nature of the diet, and the diminished amount of water absorbed from the large intestine owing to the motions being passed more frequently, and thus being retained for a shorter time in the colon.

The peristaltic movements of the bowel are stimulated by the intake of food to the stomach, and even by sucking efforts without obtaining food, and may extend to the large bowel and result in the passage of a motion. Hence it is important that feeding should not be at frequent and irregular intervals, and that constant sucking should be avoided, as overactive peristalsis may be started with frequent watery motions, and a disturbed habit of the bowels thus acquired. The old-fashioned practice of giving the young infant purges to clear out the meconium, under the impression that the child is better when rid of it, is especially to be reprobated. The meconium is the natural lubricant and protection to the delicate intestinal mucous membrane, and ought to be evacuated gently, so that the bowel becomes gradually accustomed to its new contents. Further, violent and disturbed action of the bowels, such as may be set up by the use of aperients at this early stage of life, is liable to throw the delicate mechanism of the muscular movement of the intestine out of gear for some days.

The Excretory System.—Although excretion of urea is carried out during fœtal life by the placenta, the presence of small quantities of urea in the liquor amnii, increasing in amount as the pregnancy approaches its termination, shows that the kidneys, even during intrauterine life, have begun to excrete. Urine is found in the fœtal bladder from an early stage; in abortions, from the fourth month or so, a minute stream of urine may be passed, especially when the fœtus is extracted by the legs so that there is considerable pressure on the abdomen.

Also in those cases of malformation in which there is some obstruction in the urinary tract, extreme distension of the fœtal bladder, or dilatation of the ureters and kidney-pelvis may occur. The urine passed by the child at birth is clear, like

water, and contains little urea, thus showing that the renal function has scarcely begun. The kidneys are in working order, but their real task does not begin till the placental function is withdrawn, and the excretion of urea falls entirely on them. The amount of urine passed in the first day or two is often small; later the urine becomes more coloured, and sometimes the napkin has a deposit of reddish sand, due to the presence of uric acid or its salts.

The Nervous System.—Unless born in a condition of white asphyxia (p. 285), the nervous system of the newborn child reacts readily to stimulation, and, as will be gathered from the preceding pages, such stimulation is the means by which many of the organic functions are brought into action; *e.g.* respiration and digestion. Pain, cold, and discomfort readily excite a response in crying and restlessness. It is important that the sensitive nervous system should be as little disturbed as possible, and hence all sudden, violent, or frequently-repeated stimulation should be avoided.

When newly born, a healthy infant usually gives a lusty cry, and it is a good thing that this means of inflating the lungs should come into action at once; but if the child is undersized and feeble, or if breathing has been established, the less stimulation the better; and throughout the early months of life, the less handling, joggling, and playing with the better for the gradual development of the nervous system.

The special senses are little developed at birth; though the pupils react to light, the power of fixing an object and of working the eyes together is not acquired till the child is a few months old. This lack of control over the eyes is shown by one eye being moved whilst the other is still, or even by one eye being opened whilst the other is shut. Winking and the shedding of tears are rarely seen in the very young infant. Hearing is probably not developed until the tubes leading from the throat to the middle ear (the Eustachian tubes) are cleared and opened up in the first few days of life; but even then the infant reacts but slightly to sounds, and only gradually learns to appreciate them. Taste and smell, which is closely allied with taste, are present to some degree from a very early age, as shown by the appreciation of sweet substances and the refusal of bitter and distasteful food.

The same inco-ordination of the movements of the limbs as was mentioned in regard to the muscular movements of the eyes, is noticeable in the efforts the young infant makes with its arms and legs, and is one of the reasons of the extreme helplessness of the human baby. The acquiring of control over its muscular movements comes slowly and gradually, and it is as well that the mother should realize that squinting and other inco-ordinate movements do not mean that there is anything wrong with her baby.

The young infant, when not being fed, is usually asleep, and wakefulness, restlessness, and crying indicate hunger, pain, coldness, or discomfort from clothing or other cause.

Regulation of Body Temperature.—The mechanism by which the body heat is maintained is only gradually developed, and hence the newborn infant is very sensitive to changes in its external temperature, and great care should be taken to keep it as far as possible at the ordinary temperature of the body, which, in nature, would be obtained by close contact with the mother. The temperature of the newborn infant is often subnormal, but during the first days of life, before breast-food is available, temperatures above normal are sometimes recorded, especially when there is a marked loss of weight. It is difficult to say whether the loss of weight or rise of temperature are cause or effect, but the coincidence is frequently noticed on the charts of newborn infants in hospital.

The infant's temperature varies more readily and more widely than in adults.

Hygiene and Protection from Infection.

Without minimizing the benefits of sound hygiene and good nutrition to the pregnant woman, it is nevertheless very remarkable how nature's effort for the reproduction of the species will assert itself even under unfavourable conditions. The midwife will often be struck by noticing how a plump and well-covered baby may be born to an ill-nourished and half-starved mother, and how such a mother may even have a plentiful supply of milk for her infant. Women with disease of

lungs or heart, or some grave and incurable disease, may give birth to babies of normal size and development. Apart from those born prematurely or injured during birth and the rare instances of serious malformation, the baby generally appears healthy when born and the troubles come later. In a small proportion of cases these troubles are due to inherited disease, of which syphilis is the one that comes first to mind, but in the vast majority of cases they arise from mismanagement, infection, or other preventable cause, and the whole purpose of the infant welfare movement is to lessen the waste of infant life and the damage to sound physical development from such preventable causes. A check to the normal development of the young and growing child may result in serious and permanent damage, much more so than if the trouble occurred at a later age when growth was less rapid or was completed.

Though the midwife has only charge of the infant for say the first two weeks of its existence, she has a very important part to play in seeing that the baby has the best possible start in life, and in teaching and advising the mother as to the care of her baby. On these grounds it will be as well to discuss the general principles underlying the hygiene and management of the baby, and the dangers it runs and how they can be avoided, the signs of healthy development and the first indications of disturbance.

Infections and their Prevention.—Reference should be made to the section in the Introduction dealing with Bacterial Infection, and particularly to pages 26–29, dealing with resistance and immunity, as first consideration must be the infections to which the child is exposed, the channels by which they may obtain entrance, its powers of resistance to them, and, finally, their effects.

During intrauterine life the fœtus within the closed sac of the amnion is protected from bacterial infection. Until the sac is ruptured, the only route by which organisms can obtain access to it are by the maternal blood stream and through the very effective barrier of the placenta. The undamaged chorionic epithelium is so efficient in preserving the fœtus from infection that only in rare instances and in certain special infections, such as syphilis, in which probably the chorion is injured so as to lose its protective powers, can organisms penetrate to the fœtal blood stream. As soon as the membranes rupture and still more after birth, the infant at once has to deal with bacterial infection without the protection of the mother and the placental filter, and we must, therefore, consider how far it is equipped to resist invasion by organisms. First of all, it is provided with the general resistance to bacterial invasion of the cells and fluids of its body, especially the bacteria-destroying action of its white blood-cells (phagocytes) (p. 27). This action is, however, one in which previous exposure to infection and successful resistance to it plays an important part by the production of " antibodies " which in afterlife will act as antidotes and produce some degree of immunity to infection (see p. 29), whereas its body tissues and fluids have had as yet no experience of resisting infection.

On the other hand, some degree of the immunity acquired by the mother is transmitted to the tissues of the fœtus, probably as part of the exchange between the two bloods, described in the physiology of the placenta on page 63. Several points may be quoted in support of this : the presence of an immunity-reaction in the child to an infective process from which the mother has suffered ; the cases in which smallpox or other infective disease has occurred during pregnancy and the child has been protected ; the immunity acquired by races to infective diseases prevalent among them, and the gradual lessening of the seriousness of such diseases in the course of several generations as contrasted with the dire effects of a newly imported disease to a community unused to them (*e.g.* measles among the South Sea Islanders).

The colostrum and milk from the mother's breast also appears to contain some of the antidotal bodies and afford further protection to the infant if suckled. But the measure of protection of the infant to infection is undoubtedly less than that possessed by the mother and certainly is not lasting. Further, the protection can only apply in any marked degree to infections of which the mother has had some experience, and to those forms of infection to which immunity can be acquired. Hence the young infant must acquire for itself fresh protection against bacterial

invasion, its powers of resistance must be strengthened, and every effort made to avoid the risk of infection. It is needless to enumerate the many infections to which the child is liable. During birth the risk of infection of its eyes from vaginal discharge calls for special measures described elsewhere ; the care of the cord and the raw surface left after its separation is necessary because of the possibility of septic infection with the serious consequences mentioned on page 296 ; the mucous membrane of the respiratory tract may be infected from the air, producing colds, bronchitis, and broncho-pneumonia ; the digestive tract may be infected by unclean food or sucking dirty things, and so on. Newborn infants are rarely attacked by the specific fevers, such as measles and scarlatina.

Abrasions on the skin form another channel by which infections may enter. In the case of birth injuries, every precaution must be taken to keep them clean and encourage healing, and, while the child's skin is soft and easily injured, care must be taken, especially during drying after the bath and in regard to the thin and moister skin about the folds of the body. Sore buttocks and pemphigus (p. 298) may be mentioned as other infections of the skin. Exposure to the air dries and hardens the skin, and in the folds this process may be aided by powdering. The cleansing of the mouth, nose, and ears if not done with the utmost care may result in abrasions of the delicate mucous membrane. A piece of soft lint should always be placed over the finger when cleaning out the mouth and nose, and the constant repetition of this process, such as became fashionable for a time, is to be deprecated as likely to do more harm than good. Efforts to get every little bit of vernix out of the scalp and crevices and folds of the ears only provide further possible openings for infection.

The infections to which the young infant is particularly liable are those of the respiratory and digestive tracts, so that it will be best to consider in detail what can be done to lessen the chances of such infections. The body temperature in a newborn infant is not stable, and, as already explained, its capacity to withstand extremes of temperature is but slightly developed. Therefore it is very important that its heat-regulating mechanism is not overtaxed, but gradually trained by increasing variations of external temperature. Too much time must not be spent over the removal of the vernix and the bath ; chilling may readily occur and the resistance be lowered. On the other hand, the room must be well ventilated, as a close, stuffy, and sunless room increases the chances of infection. As was mentioned for the puerperal infections (p. 244), nothing increases the powers of resistance more then fresh air and sunshine. In many cases the housing of the patient may not allow of any sun and of little fresh air, but the attendant must endeavour to do her best in the conditions. In cold and foggy weather this may be difficult, but an effort should be made to keep the air of the room in free movement, the child's cot being screened from direct draught, and kept warm by hot bottles. The vasomotor system should be trained gradually by exposure for short periods to cooler air than that of a room, and, weather permitting, the sooner it can be taken out into the fresh air the better. The greatest risk comes from infections from cold and catarrhs in those in attendance on the infant and others in the house, or visitors who come to admire the new arrival, and especially if they insist on fondling or kissing the child. This risk of infection from others is the great objection to mothers taking their babies —often by tram, bus, or other public conveyance—to a crèche or clinic where numbers of other infants are congregated, some of whom are sure to be snuffling or sneezing.

The precautions to avoid respiratory infection may be summed up in a good hygiene to improve resistance to infection, graduated training to enable the child to adapt itself to changes of temperature, as little mixing with the general public in a closed space as possible, and particularly the avoidance of contact with all known to have influenza, colds, or other infectious conditions.

The digestive tract at birth is free from organisms, in a day or two it is probably teeming with them ; but so long as they are of the ordinary saprophytic type and the mucous lining of the tract remains undamaged and healthy, no harm will result. It is what happens invariably ; the intestinal canal normally is full of bacteria.

To the newborn child it is important that the bacterial invasion of the digestive canal should occur slowly, so that it can accommodate itself to the new conditions,

that no septic or virulent varieties of organisms should be present, and that the mucous lining of the tract should be uninjured. This implies the strict prohibition of putting comforters or dirty fingers into the infant's mouth, of giving extra feeds before the mother's breasts are active, except for special reasons and with special precautions, and of the kissing of the child by all and sundry, many of whom are sure to have bad teeth and septic mouths ; the nipple must be cleansed and every effort made to minimize the possible sources of intestinal infection. The warnings already given against injuring the delicate lining of the mouth and against purging the child to get rid of the meconium may be recalled as of moment in avoiding injury to the digestive tract.

With attention to the points mentioned, and, above all, the natural feeding of the child from the mother's breast, the risks of serious intestinal infection will be greatly reduced.

Signs of Normal Development and its Disturbance.

Though it may not appear strictly in the logical sequence, the signs of normal development, by which the progress of the child is judged, together with the early indications of disordered function and disturbed nutrition, will be considered before the management of the infant. Some knowledge of these signs is necessary if the management and feeding is to be adapted to the infant's requirements.

Weight.—A weekly or bi-weekly weighing of the baby is necessary to obtain the evidence it gives of normal progress or otherwise. A check to the increase in weight of the child is the equivalent of actual loss in weight by an adult whose bodily growth is completed. As evidence of the steady building up of the frame, great reliance is rightly placed on a regular increase of weight, but the inexperienced are apt to concentrate on this sign to the exclusion of others.

The all-important point to be recognized is that the weight should progress along normal or average lines, and that no attempt must be made to press the increase. Pride in obtaining rapid increase is not to be encouraged ; our object is not to produce a child that will take a prize at a baby show or serve as an advertisement plate for a patent food, but a healthy child that will grow up into a healthy adult. For this reason the average variations in weight from birth require consideration. During the first three days there is a natural loss owing to the burning up of tissue before food is taken, and to the passage of urine and meconium. This loss varies from a few ounces up to a pound, but the amount depends on several factors. A big and active baby will burn up more to keep up its body heat and provide for muscular movements than a small and sluggish one. This initial loss is regained about the middle of the second week, the time varying also according to circumstances. The birth weight is regained earlier in breast-fed babies, particularly if the mother has suckled others before, and in small but healthy babies in which the loss to be made up is slight. It is later in the bottle-fed babies, in those at the breast when there is delay in the milk coming in, and with first babies. Those fed at four-hourly intervals do not usually regain their weight as soon as those fed at three-hourly. A delayed return to the birth weight apart from continued loss is of little consequence, and no anxiety need be felt if it is postponed for even as long as three weeks, provided all other signs of progress are satisfactory. This is particularly true in artificial feeding, as time is required for the digestive functions to adapt themselves to the unnatural food, and it is better to go slowly rather than run any risk of overtaxing them.

Once suckling has begun, the child puts on from 4 to 6 oz. a week, though an occasional gain up to $\frac{1}{2}$ lb. is not unusual. This gain is maintained for the first six months of life, but at a gradually diminishing rate, averaging over 1 lb. a month, and in the second six months a little under that. Usually the birth weight is doubled in the sixth month.

Our object should be to have the increase in weight correspond roughly to the standard of about 1 lb. every four weeks, and that it should be steady, though slight irregularities from week to week are of no moment. A stationary weight persisting over two or three weeks, or loss of weight, even unaccompanied by other evidence, is

proof of malnutrition and a warning that more decided trouble will follow if the cause is not discovered and removed. Malnutrition without other apparent sign of ill health means that the infant's resistance to infection is lowered. A gain over several weeks markedly in excess of the average is also a warning of possible trouble to come. It frequently precedes digestive upset, and, in any case, indicates that more food is being given than is required for physiological development, with a consequent strain on digestion, assimilation, and excretion. Daily weighings are only necessary in cases of illness or malnutrition, and are then of great value in estimating the progress of disease and the success of measures taken to counteract it. Nearly all illness is accompanied by either a cessation in the gain or by a loss of weight, usually the latter, particularly if there is much loss of fluids from the body, as in diarrhœa or vomiting, or an increased consumption of material, as there is in fever in order to maintain the raised temperature. After illness, especially digestive disorder, the rate of increase of weight may be slow, and caution is necessary. The temptation to hasten the regaining of the lost weight is great, but it must be kept in mind that not only does a digestive system that has been disturbed resent being overtaxed, but also that a weak and listless infant requires less food than a strong and active child of the same age. In such cases the amount of food for the average infant of that age must be diminished to meet the limited digestive powers and the lessened requirements, and only gradually brought up to the average as digestion becomes normal, and the child recovers its muscular tone and powers.

Once this recovery has taken place, the food may be increased even to beyond the usual for a child of that age, but as soon as the weight approaches the normal line the ordinary requirement should be adhered to. The modification of diet during sickness and convalescence is very difficult, and requires medical knowledge and experience, though the midwife should understand the principles underlying it.

The Appearance and Behaviour afford most valuable evidence as to how the child is thriving, and should correspond closely with the points noted under the physiology of the infant. The pink colour of the newly-born infant fades somewhat in the first few weeks and, in feeble and immature infants especially, may be obscured by the yellowness of jaundice (p. 296). Pallor may be due to anæmia or to weakness of the heart. The paleness of anæmia is persistent and gives a waxy appearance to the skin, well seen in the almost semi-transparency of the lobes of the ear, whereas the pallor from faintness comes and goes, being especially frequent when some strain has been put on the circulatory apparatus, as after the bath or bouts of crying ; is more of a dead white, and is often in marked contrast to the appearance of a few minutes before, *e.g.* the child may become red in the face with crying, and then collapse with pallor of the face as the result of the effort. A red flush on the cheek and a vivid colour of the lips and mouth may be present with febrile conditions ; blueness about the mouth and lips and blueness and coldness of the hands and feet are evidence of feeble circulation, and when noticed, particularly after the bath, are a sign that these ought to be limited in number and in the duration of the exposure, or possibly that cleansing with oil should be substituted until the power of controlling the distribution of the blood supply is better established.

Sweating may be due to over-clothing and over-heating, but may be present independent of this in flabby, ill-nourished babies. The thin and poorly covered infant may make good progress, but firm, well-covered limbs and body are good evidence of a well-doing baby, and especially if the movements are active, as, for instance, in the bath.

When not being fed or bathed the healthy infant is usually asleep, and that it should wake up for its food and, when satisfied, contentedly relapse into slumber is the best of signs. If the child is wakeful, restless, and crying, it is probably hungry, or ill and in pain, or suffering discomfort from cold, over-heating, clothing, or other cause. An ill baby, especially if suffering from serious malnutrition, often lies awake, with the eyes open and staring, but with a vacant look as if drugged. This appearance is of ill omen in premature and weakly infants.

Digestive Functions.—Food should be taken readily, and afterwards the child should appear satisfied and sleep comfortably. After the meconium has disappeared two or three soft motions of the colour and consistence of custard should be passed

in the twenty-four hours. Disturbance of the digestive system may or may not be due primarily to disorder of the gastro-intestinal functions, for nearly every illness is accompanied by symptoms of digestive disturbance, as, for example, the vomiting which so frequently ushers in an infective illness. The physiology of the infant is so largely comprised in the digestion and absorption of material for its growth, that symptoms of disorder of these functions occur in nearly every ailment, wherever originating.

Therefore digestive disturbances as an indication of illness have an undue prominence in the infant as compared with the adult, and must always receive immediate attention, for their significance may not be clear at once. Such symptoms as vomiting, eructation of wind and sour fluid, persistent hiccough, colic and griping pains, may be evidence of digestive disorder. The character of the motions are a valuable indication of progress of the digestion and proper assimilation of food, and should therefore be carefully observed and noted. The significance of hard dry, and constipated motions, or the passage of greasy fatty motions or masses of curd, and of mucus and blood, will be referred to elsewhere (p. 278), as also the state of the mouth and sore and irritated buttocks. Regularity in the action of the bowels is as important as regularity of feeding, and much that is said of the latter (p. 266) holds good for the former. The bowels tend to act after feeding, and an effort should be made from the first to start the habit of their regular action after the morning and evening feed. By holding the baby over a bowl or small chamber at definite times in the day, it is remarkable how soon the habit is acquired. At first it may be necessary to tickle the anus, or gently press the oiled little finger within the sphincter, but soon the posture is sufficient, if regularly adopted. It is obvious that once acquired, this habit of regular evacuation of the bowels will not only be advantageous to the infant's health, but will save time and labour to the mother in keeping the child clean. Warnings should be given against the giving of purgatives, powders, and nostrums of any kind.

Other Evidence of Disorder.—Rapid breathing, especially with movement of the nostrils and the mouth open, is evidence of respiratory trouble or heart disease ; if accompanied by blueness, the condition is clearly serious. With shortness of breath the child cannot give a loud or healthy cry, because it cannot take the necessary breath.

Other signs of disease may be shown in convulsions (p. 298), the drawing back of the head towards the shoulders, doubling in of the thumbs and wrists and various forms of paralysis (pp. 291–292). Restlessness, constant crying, and evident pain always require medical advice.

The strong bold cry of the healthy infant is usually due to hunger or thirst or temper from discomfort or annoyance. When overtired from want of sleep, loud continued crying may also be present. Sudden bursts of short duration suggest colic or griping pains ; but if pain is continuous and exhausts the infant, the cry becomes more moaning or wailing in character, and in the exhausted infant a mere whine. A sudden piercing cry may be due to injury to the skin, a pricking pin, or burning by a hot bottle. Notice should always be taken if crying starts with the movement or touching of any part, on passing water, or with some particular action which may explain the cause. Investigation should be made to find the cause of persistent or unusual crying, and if none can be found that when removed brings cessation, further advice should be obtained.

These points are mentioned to suggest to the midwife careful observation of the young infant, and the immediate reporting of any signs she may detect of departure from the normal physiological behaviour. Only by such means can assistance be obtained in the early stages of disease.

Management of the Infant.

After the cord has been tied and divided the child is wrapped in a warm flannel receiver and put in a warm and safe place until the mother no longer requires the attention of the midwife. An occasional glance at the infant is necessary to see that the cord is securely ligatured and that all is well. When the mother has settled

down to rest the baby may be attended to. First of all, everything must be got ready for bathing and clothing the child. *Vaseline* or *olive oil* for removing the vernix caseosa ; *toilet soap*, which must be free from soda, which will injure the tender skin—ordinary household soap contains excess of soda, to which its cleansing powers are due, and is therefore unsuitable ; some form of superfatted soap ought to be used ; a *washing flannel* and *soft towel* ; a *dusting powder*, such as starch, boracic acid, or oxide of zinc ; *squares of linen* for dressing the cord, cleansing the eyes, etc. ; *needle and thread*, *safety-pins*, *scissors*, etc.

The bath should be placed on a chair by the fire and filled with water at a temperature of 100°, determined by a thermometer and not by guessing, and the above-mentioned articles arranged within easy reach. The clothing also should be warming by the fire and arranged in the order it will be required. The midwife, sitting on a low chair with a mackintosh over her knee and over it a flannel apron or small blanket, takes the infant on her lap and examines it thoroughly for birth injuries and malformations (pp. 290–293), and sees whether the ligature on the cord is secure, retieing it if necessary. The eyes, nose, and mouth are wiped free of mucus with a piece of soft linen or pledget of wool, and if there is much vernix it is removed with warm olive oil or vaseline. Generally the scalp is the most difficult part to rid of the greasy vernix. The face and head are washed first and then the body—the soapy flannel being dabbed on the skin rather than rubbed until the whole surface has been covered. The child, supported by the left arm, is then immersed in the bath, except for the head, from which the soap is carefully rinsed off by sponging, care being taken that the soapy water (which is also contaminated by what has been washed off the child) does not get into the eyes. The child is then lifted out of the bath, wrapped in a warm towel and dried by dabbing so as not to rub the tender skin, and special attention given to the ears and all creases and folds of the skin. When thoroughly dry, the armpits, groins, and buttocks are dusted with powder. The cord must be carefully dried, well powdered with boracic acid, and wrapped in a piece of sterile lint or gauze and laid on the abdomen in an upward direction to avoid its being soiled by urine. The traditional dressing in a piece of scorched linen is a good one, as the scorching sterilizes the dressing and helps it to absorb moisture and so dry up the cord. The principal object is to keep the cord dry, so that it shrivels up and mummifies. If it remains moist it will putrefy, and any infection of the cord is dangerous and a possible cause of death of the infant (p. 298). The best plan is to cut a hole in the dressing which will just admit the stump of cord and use powder freely.

A flannel binder 5 inches wide and 2 feet long is then placed round the abdomen to keep the dressing in position and fastened by stitching.

The best time to see to the eyes is just after the bath, but it is not necessary to do more than wash them with a piece of lint or linen soaked in boracic lotion. Unless there has been some vaginal discharge, so that special treatment is required (p. 293), it is inadvisable to open the eyelids and drop fluid in.

A diaper is then folded into a triangular shape and two ends brought round the hips and one between the legs and pinned with a safety-pin, and the clothes, which should not be tight, put on. Nothing stiff and hard which will interfere with free movement must be used.

The infant is then put in its cot and care taken to see that it is kept warm. An effort should always be made to see that a separate cot is provided. Even in the houses of the very poor a box cot can be improvised, and so long as it is warm the child is better there than in bed with the mother, where it runs the risk of being suffocated by overlaying (p. 80).

During the period of her attendance the midwife should devote as much time and attention as she can to the education and training of the mother in the care of her infant, and this will be most effectively done by her own management of the baby whilst she is in charge, and by explaining the reasons for all she does.

The bath should be given daily, unless from prematurity or weakness the exposure it entails should be dangerous, when oiling is substituted (p. 281). Some advise against the complete immersion of the infant till the cord has separated, and would have the child washed on the knee of the nurse or in a shallow bath, so that the cord is kept dry. The invigoration and cleansing of the bath is, however,

so valuable that this precaution appears needless, provided care is taken to dry the cord thoroughly and keep it dry with powder and dressing. Great stress must be laid on the care of the cord and the area left after separation, and of the skin generally. The genitals and buttocks require particular attention ; in the case of female infants powder should not be applied to the vulva, as it may irritate. The folds should be gently washed from above downwards, dabbed dry, and an ointment used if there are any signs of local irritation. The clothing of the baby should be warm but not excessive. The tendency among the poor is rather towards over-clothing and over-weighting the newborn infant. Nothing must be done to constrict free muscular movement of the trunk and limbs or to impede circulation, and hence tapes and binders and heavy clothing should be discarded. The binder is not required once the cord is separated and the navel healed, and ought always to be loose enough to allow free abdominal movement. The napkins must not come down so low as to interfere with movement of the thighs, and should fit closely, but not tightly. Emphasis must be laid on frequent changing and removal when soiled, and on their being washed at the earliest possible moment. The happy mean between coddling and keeping the baby overwarm and exposing it to cold with a view to hardening it, is not an easy one to hit, but two points are clear—first, that the very young infant is not able to make up for great loss of heat ; secondly, that sudden changes in clothing or surrounding temperature are especially to be avoided, and the child very carefully trained to accommodate itself to changes of temperature. Fresh air and ventilation must be secured with the minimum of tax on the heat regulation, and so long as the hardening process is made gradual enough and the effects on the individual observed, no harm will come from a courageous departure from the old-fashioned coddling and swaddling of the baby. Provided it is suitably protected from wind and cold, the baby may have a short airing in fine weather from a few days old, certainly after a week or ten days. Cleansing of the mouth and nose is unnecessary, and should be prohibited for the reasons already given (p. 257).

CHAPTER XXV.

THE FEEDING OF THE INFANT.

The natural feeding of the infant by the mother is the factor most essential in preventing infantile mortality and disease, and the midwife must do all she can to advise and help the mother to carry out breast-feeding in the best way (see C.M.B. Rules, E 12A and note). Cases of unwillingness on the part of the mother are not so frequent in the practice of a midwife as that of a doctor. They will chiefly occur among women who wish to resume work (such as single women who have to earn their own living), and only rarely be cases in which the mother is unwilling to undertake this duty because of its being a burden to her, for, with little or no domestic help, bottle-feeding is a much greater tax than breast-feeding. Should the midwife come across such cases, or should she discover or suspect that the mother intends to discontinue breast-feeding once she is up and about, her best plan is to exert what influence she can to persuade the mother to suckle her baby for at least a month, and to pass on any information or evidence she may obtain to the health visitor. Both midwife and health visitor are workers in the health service of the community, and if there is proper teamwork among its members such exchange of information ought to be the rule.

The unwilling mother is usually impenetrable to reason or argument, but the midwife should have clearly before her mind the justification for urging the natural feeding from the mother's breast.

There is the evidence of statistics which show the greater mortality among bottle-fed babies, especially during the hot months, when summer diarrhœa is prevalent, the death-rate then being about ten times what it is in the cold months. In a battle those killed are but a fraction of the wounded and the death-rate does not show the whole of the casualties ; there are the much greater numbers of babies with damaged health and constitution of which the mortality figures give no indication. We know that the breast-fed baby obtains its food of the strength and quality prepared for it by nature direct from the nipple without the chances of contamination that surround dairy milk in its transit from the udder of the cow through pails, churns, and cans, from cowshed in the country, by road and rail, to shop and street, before it is delivered in the house or made up in the baby's bottle. The chances of souring and fermentation in hot and thundery weather explains the huge rise in infantile diarrhœa and mortality at these seasons.

The argument from physiology may be gathered from what is said elsewhere regarding the difference in composition and character of the primary food substances in cow's and mother's milk. No more need be said here than that nature arranges their characteristics and relative proportions to suit each species, a high protein content for those animals which grow quickly (rabbits, dogs, and cats), and high fat ratio for those which have to withstand great cold (whale, porpoise, and reindeer). The character of the food is suited to the digestive capacity of the individual animal, the tough firm curd of cow's milk to the ruminating stomach of the calf, and the thick oily fat to the digestion of the seal or porpoise and so on. Though extraordinary success has been attained in producing a fluid similar in composition to breast milk, no substitute can ever be as good as that provided by nature. The unconvinced and unwilling mother may point to the success of bottle-feeding in individual cases, but the midwife can always retort, that if these individual babies did so well on the substitute, how much better might they have done on the real thing, and, further, that however well a baby may do on the bottle, it has not the same chance as on the breast, as proved by the figures taken over thousands,

and not by odd cases here and there which have succeeded in spite of being denied their natural food. To the mother there is an advantage in the speedier and more complete involution of the uterus, with the diminished strain on the pelvic floor and uterine attachments when she resumes her ordinary duties, and, what is perhaps more important, the more intimate understanding of her baby and its needs that comes from complete motherhood. It is not part of the midwife's duties to decide whether or not breast-feeding ought to be undertaken, but it may be said here, that there are extremely few instances in which it is inadvisable for the mother to suckle her infant. Tuberculosis, grave heart and kidney disease and insanity, justify the weaning of the baby, but pregnancy continuing to the birth of a viable child is not common with the grave illnesses which entail prohibition of nursing. Temporary illnesses, influenza, acute fevers or breast abscess should only mean temporary cessation, if they occur during the early months of the child's life. The return of menstruation does not involve the discontinuance of suckling ; it is normal for many women to menstruate while nursing. The occurrence of another pregnancy, is, however, an indication to stop suckling, if the flow of milk does not cease naturally.

Physiology of Lactation.—The structure and mode of action of the breast has been described and illustrated on page 230. Human milk contains about 1·5–2 per cent. of protein, 3·5–4 per cent. of fat, 6–7 per cent. of sugar, the rest being water with a small quantity of salts. The variations in composition are not great, even throughout the period of nursing. The colostrum, which is present in small quantities in the few days before the true milk comes in, contains no caseinogen, but only soluble protein like that in whey, though the percentage of protein is high, about 6 per cent., or four times the total protein percentage in milk. On the other hand, there is little fat and sugar, the former being about half and the latter considerably less than half of that in milk.

Though the composition of the breast milk remains remarkably constant throughout the period of nursing, the amount secreted increases markedly in the first few weeks of lactation, and more gradually later, so as to meet the growing needs of the infant. The most decided variation in composition is not in the average of the day's supply, but in the difference between the milk drawn off at the beginning of each suckling (the fore-milk) as compared with that drawn off as the breast is emptied (the hind-milk). The fore-milk contains more fluid and less solids than the hind-milk, which is richer, particularly in fat—in other words, nature provides the soup first, and the butter and cheese at the end of the meal, as in all well-regulated families.

The secretion from the breasts is maintained by the stimulus of suckling, and in the absence of this stimulus rapidly fails. The regular and complete emptying of the breasts by the sucking of a hungry and thirsty baby, is the most essential factor in providing a good supply of milk. Too frequent suckling and insufficient intervals of rest may produce failure of secretion from exhaustion, and, though a less constant effect, forms a strong argument in favour of regularity in feeding and longer intervals between.

Much importance has been laid on the mother's diet as a factor in improving the milk-supply, but beyond saying that a good general diet of food which is easily assimilated is best, there is no reason for alteration because a woman happens to be nursing a baby.

The diet of the nursing mother has often proved a stumbling-block to success, owing to the idea that the woman must eat more food and of a specially " nourishing " type, whereas it is much more important that her powers of digestion and excretion are not overtaxed, and that she continues with the diet to which she is accustomed, with perhaps an extra supply of fluid, and that, generally speaking, she follows her ordinary routine. A little consideration will provide many illustrations of the truth of this reasoning. The working-class mother with no domestic help is a better nurse than her more affluent sister who has a special diet laid down for her, and whose attendant brings her soups and gruels between meals, so that she probably suffers from a surfeit of food and lack of adequate exertion to work it off. This was often proved when the employment of wet-nurses was common. A woman with a plentiful supply of milk and accustomed to an active life was transferred to

an unwonted rich and excessive dietary, without physical exertion. The result was usually fatal to the capacity to nurse.

Every now and then the midwife will be struck by the abundance of milk provided by some overworked and underfed, and even ill-nourished, mother. Stout may still have its traditional reputation in promoting a good milk supply, as witness the special brands labelled as "nourishing and recommended for nursing mothers," though there is little foundation for such tradition, and what there is depends on the extra fluid taken with perhaps also the caramel and malt sugar it contains. Alcohol itself is positively harmful, and here it is only necessary to issue warning against accepting without investigation the many old wives' stories of what is bad or good for nursing mothers. The old adage that "milk does not make milk" often proves true for the reason just given, that the woman unused to extra milk suffers from flatulence and indigestion. Fruit and green vegetables were often prohibited, whereas they are valuable in checking any tendency to constipation and providing the vitamins necessary for the infant's health and development, and are well tolerated when the mother is up and about. Extra fluid is required, and water up to two or even three pints in the day, taken between meals so as not to interfere with digestion, will best meet this. Otherwise special nostrums should be avoided, and her usual mixed diet, found by experience to suit her, adhered to, merely excluding rich and indigestible foods and highly seasoned articles (vinegar, pickles, curry, etc.). As healthy and hygienic a life as her circumstances will permit, avoiding extremes, is the guiding principle for the nursing mother. Costive bowels are a decided hindrance, as sluggishness there seems to be accompanied by sluggishness in other bodily activities; but every effort should be made to obtain regular action of the bowels without purgatives. Exercise in the open air, short of fatigue, with adequate rest and sound sleep, are important; it is inadvisable to suckle the child when tired, overheated, or excited, because the physiological conditions for good nursing are absent. Emotional disturbance and the mental attitude of the mother have a decided influence on lactation, and insufficient attention has been paid to this factor. Women of an anxious, excitable temperament have long been recognized as poor nursing mothers, and as requiring special care in management. Want of confidence in their own powers is a frequent cause of failure to breast feed, as also is fretting over every little passing disturbance in the baby. The emotional factor must therefore always be kept in mind, and particular care taken to remove any suggestion of non-success and, as far as can be, all impressions likely to produce worry and anxiety in those of a temperament easily upset. Daily or frequent weighing of the child has the drawback that, with mothers of this type, any temporary check is likely to upset mammary action by making them worry.

The Management of Breast-feeding.

The management must follow as closely as possible the physiological principles previously enunciated, and must begin from the time the pregnant woman is first seen. Part of the antenatal care is directed towards preparation for nursing, *e.g.* the general hygiene and attention to the breasts and nipples (p. 77). Special attention should be paid to the state of the teeth, as sepsis in the mouth is undoubtedly unfavourable to nursing. Women who have failed to nurse their babies in previous confinements and primigravidæ, particularly those of a highly strung nervous temperament, or with little confidence in their own powers, or in whom the maternal instinct appears weak, call for special guidance.

After the labour, the mother must be allowed time for rest and sleep and to recover completely from her exertions. If possible, within twelve hours of delivery, the baby should be put to each breast for two to three minutes, and this repeated at six-hourly intervals during the day till the milk flow begins. The child obtains little from the breast; perhaps a teaspoonful or so of colostrum at each feed on the first day, increasing to double and treble on the second and third days, but even this small quantity is valuable in quenching thirst and beginning the education of the digestive and absorptive functions. Some laxative action has also been attributed to the colostrum, but any such result is much more probably due to the

reflex effect of sucking and of the fluid taken in exciting intestinal action. To the mother these early nursings are chiefly of value in exciting secretion by the powerful stimulus of sucking, in drawing out the nipples and clearing the milk-ducts, and in promoting uterine contraction and involution. In women with poorly developed breasts, and in those in whom milk secretion has previously been inadequate or whose nipples are retracted, the frequency of the baby going to the breast should be increased to four- or even three-hourly intervals from the second day. Reasons against giving food or fluid to the child before the natural supply is ready were given on p. 254, and the further reason may be added here that a hungry and thirsty baby is the best stimulant of the breast, and the satisfying of its wants may result in delayed or deficient flow. If the child is fretful and constantly crying, a teaspoonful of boiled water may be given *after* suckling, and then only. If by the fourth day there is no breast milk, an ounce of humanized milk diluted with three parts of boiled water may be given *after* suckling, but at no other time. Should the breasts become hard and engorged when the milk comes in, the baby should not be encouraged to try and empty them. The excess of milk should rather be expressed by the hands (massage) or drawn off by a breast pump.

Position for Nursing.—The mother should sit up, holding the child across her body, with its head supported by the arm of the same side as the breast that is being used, so that there is no drag on the nipple. The base of the nipple is held between the first and second fingers so as to prevent the breast from bulging over the child's nose and thus causing it to drop the nipple to take breath and to allow the mother to control the rate of flow by compression of the nipple if the baby suckles too fast.

Duration.—Fifteen minutes is the average duration of each feed, and twenty the maximum ; and an effort should be made to approximate to the average. Too rapid feeding generally results in " possetting," or return of undigested milk immediately after feeding. Too long suckling causes softening and maceration of the nipples with a tendency to become sore, and for this reason the child should never be allowed to sleep with the nipple in its mouth.

Frequency.—No absolute rule can be laid down in regard to frequency, but generally six or five feeds in the twenty-four hours will be found best, *i.e.* three- or four-hourly intervals during the day and no night feeding. The tendency of late has been in the direction of lessening the frequency, and five feeds in the twenty-four hours, certainly best for infants of a few months old, are usually successful if begun at once in suitable cases. In favour of the four-hour shift is the lessened tax on the mother, with increased opportunities for other duties and for relaxation, which improves her chance of being a good nurse and continuing to suckle. Though the birth weight is not so quickly regained and the increase of weight is not so rapid at first, the progress made by the infant is excellent, and the risk of a set-back from digestive disturbance is greatly diminished, as the longer interval gives more rest to the digestive tract and there is less likelihood of overfeeding, by far the most common cause of digestive upset in the breast-fed baby.

As babies and mothers are not all alike, the following rough guide may assist towards a decision. In the case of a baby up to the average in size and strength and a mother with a plentiful supply of breast milk, there is a great advantage in breaking the child from the start to the habit of five feeds in the twenty-four hours ; if the baby is small or feeble, or if the supply of breast milk is scanty, six feeds should be preferred, as more suited to the capacity of the child and affording more stimulus to mammary action ; as the child becomes stronger or the supply of milk more adequate, the change can gradually be made to five feeds in the twenty-four hours. Both breasts are often required in feeding at the longer intervals.

Regularity.—As must be evident to any one who has watched suckling animals, nature knows no regularity in feeding times. Why, then, make regularity part of a physiological system ? Though the analogy from animals which browse and feed the day long, or hunt their food and eat it when they can find it, scarcely holds good for human beings living under civilized conditions, it may be as well to explain that regularity in infant feeding is advisable because of our social conditions, and is essential because there is no middle course between it and the casual

haphazard way of the animal. The reasons for it may be given as they concern (1) the mother, (2) the child.

(1) Regular feeding times make sure of the breast being worked and rested, so as to obtain the best results from it, and make the duty less irksome to the mother by the fixed hours, allowing her to arrange other duties so as to fit in with them. As with many other organs the breast responds to rhythmic use and develops a periodicity which improves its functional power. Lessened strain to the mother is always a help to good nursing—witness the great help resulting from the freedom from disturbance at night brought about by the abolition of night feeds.

(2) Regularity in feeding secures the proper apportionment of work and rest to the infant's digestive tract, such as cannot be obtained by casual methods. Under the special conditions of our civilization, the establishment of regular habits—of eating, sleeping, movement of the bowels, etc., are of importance to health, and the infant should be disciplined into them from the start of life. A baby differs from the suckling animal or from the baby of the uncivilized savage in that, as he grows up, his mealtime, sleeptime, playtime, and worktime will be determined by social circumstances. The careless, shiftless, and ignorant mother whose child is brought up without method, and given the breast whenever he cries for it, is injuring both the health and character of her child. Not only is he likely to have disturbed digestion and irregularities in the action of the bowels, but he is acquiring the slipshod ways of his parents, and without discipline in self-control he grows up self-willed and unable to adapt himself to our social customs and is neither physically nor morally a credit to the race. This latter aspect is one that is often lost sight of ; when the midwife comes across a mother who is capable of appreciating the importance of this early discipline and of its effects on the future upbringing of her child, she should take the opportunity of explaining it as one of the benefits of inculcating regular and systematic habits from birth.

Care of the Nipples.—The nipples should be washed before suckling to lessen the chances of bacterial infection of the infant's digestive tract. After suckling, they should be cleansed again, dried, to prevent softening of the surface, and covered with a pad to avoid soiling of the garments by the escape of milk. If there is sufficient leakage of milk to keep the pads wet they should be changed frequently, as, sodden with soured milk, they will damage the nipple and be a possible source of infection to the child. Any soreness or cracking of the nipples must be attended to (p. 249).

Use of Both Breasts.—The use of one or both breasts at each feed can only be decided for each individual case. With five feeds in the twenty-four hours, both will probably be required, unless there is an ample supply of milk ; with six feeds one will suffice. A good plan is to allow the baby eight to nine minutes at each breast, increasing the time at the first breast and diminishing that at the second as the flow improves, until it is seen if one breast will suffice. The important point is that both breasts should be used equally, and in order to secure this some system is necessary. If left to her own devices, the casual mother may overwork one breast, generally the left because she carries her baby on the left arm, so that that breast comes handier. If only one breast is used at each feed, each breast is used alternately ; if both breasts are used, suckling should begin from the right and left breasts alternately. This rule is particularly important when the second breast is only partially exhausted, as the complete emptying of the breast is essential to the full stimulation of secretion. Also, the difference in the composition of the fore- and hind-milk, as noted on page 264, renders some system of the kind advisable. With no night feeding it is important that the baby should have a large feed at 10 p.m. or last feed at night, and hence for this feed both breasts are generally necessary.

Deficiency of Breast Milk and Failure to Nurse.

The percentage of women willing but unable to suckle is very small ; as already mentioned, the activity of the breasts of ill-nourished, anæmic women is often unexpectedly good. Indeed, failure is more common with the fat gross type than the thin spare type. Poor development of the breasts is a very rare cause. The most common causes are depressed and deformed nipples, making it difficult or impossible

for the child to suck satisfactorily, cracked and sore nipples, inability to suck or to empty the breast on the part of the baby, as from prematurity and feebleness, harelip or cleft palate, or nasal obstruction from catarrh or other cause. Besides these causes and apart from refusal, unwillingness, or mismanagement, an anxious, excitable temperament in the mother—and lack of confidence in her own powers is the most frequent reason for resort to bottle-feeding. Those who have the greatest success in promoting breast-feeding will have the faculty both of influencing the unwilling and of reassuring and inspiring confidence in the nervous and faint-hearted. The C.M.B. Rules say that " the midwife should endeavour to promote breast-feeding " (E 12A note), and therefore suggestions will not be out of place as to how to convert the pious sentiment into practice. It has already been laid down that temporary or permanent cessation of nursing is never a matter for the decision of the midwife, as all conditions in which non-suckling is indicated, whether on account of mother or child, are conditions for which medical advice is necessary (pp. 264 and 250). So also if her management of retracted or sore nipples has not been successful, or if the child is feeble, or its powers inadequate to excite the full activity of the breast, further advice should be sought. With the unwilling mother, the midwife must use her personal influence and powers of reasoning, and also suit her argument to the type of mother she has to deal with ; to the selfish woman with little maternal feeling, she will emphasize the advantages to her own health and the saving of trouble and expense ; to the ignorant and stupid mother, she will lay stress on the simplicity and ease with which breast-feeding can be conducted as compared with bottle-feeding and the lessened chances of troubles in rearing the baby. To the mother who has failed before, she will give confidence and the assurance of success by her care in investigating and removing the causes of former failure, and enlisting her interest and co-operation in carrying out better methods. When she finds success unlikely she should get other influences to bear, from health visitors, maternity centres, as mentioned in Rule 12A. The point to be kept in mind is that the chances of the bottle-fed baby with the casual, stupid mother are poor indeed, and hence every means to secure natural feeding are particularly required. In the case of the nervous and highly strung woman, all suggestion of failure must be removed from her mind, and care taken to counteract any antagonistic influence from neighbours and relatives, for women of this type are readily influenced. Once the labour is over, success with the infant spells success with the mother, and *vice versâ*. Even trifling and temporary trouble in the baby will suffice either to prove to the mother, what she knew all along, that she has not enough milk, or if she clearly has, that her milk " doesn't agree " with the baby, or the fretting and crying child will be a source of so much worry that the milk flow will become inadequate, if it was not so before.

In many cases in which the milk " does not agree " or appears to cause digestive upset, careful observation of the child, the way it takes the breast and behaves after sucking, may suggest the remedy. A hungry and thirsty baby may bolt its food very quickly, and if nervous and excited in going to the breast may swallow in great gulps, producing flatulence and indigestion. Sometimes one or two teaspoonfuls of boiled water before meals will diminish these tendencies to rush the start of a meal, and when food appears to be poorly digested one or two grains of sodium citrate to the ounce of water may be tried instead of plain boiled water. A quarter or half a tabloid of " soda mint " in a teaspoonful of water before feeding is occasionally successful. If the baby is restless and constantly crying, the midwife should find out if this is due to mismanagement—to delay in changing diapers, to overheating or overclothing, to the lack of warmth, or to too much handling and interference with its proper rest—and if there is no adequate and simple cause which can easily be removed, or if there is evidence of digestive disturbance, wind, colic, vomiting, diarrhœa, nasal catarrh, or other illness, medical advice must be obtained at once.

Remembering the liability of the young infant to infection, colds in other members of the household or the prevalence of influenza may suggest the origin of the trouble, whether in the respiratory or digestive system. If the digestion is upset by the feeding, it is more commonly due to over-feeding than under-feeding and herein lies the difficulty in breast-feeding, viz. of knowing how much the child

actually obtains from the breast. This information can only be obtained in one way, and that is by test-weighing, not an easy matter outside a hospital, as much more delicate scales than the ordinary baby-weighing balance are required, for they must weigh to $\frac{1}{4}$ oz., but if such scales can be obtained from an infant clinic or elsewhere, the test-weighing itself is easily done. The baby in its clothes is put on the scales and balanced exactly, then goes to the breast, and is put back on the scales after it has finished its feed, the additional weights added to make it balance again give the amount obtained from the mother. Such test-feeds must be taken over at least twenty-four hours, and preferably over forty-eight. The quantity taken at each feed shows considerable variations ; usually the first in the day is the largest, and the midday the smallest. In difficult cases, these test-weighings are the only means of learning the essential point—exactly how much the child obtains from the mother, and without this knowledge we are working in the dark. Provided there is sufficient milk, there need be no question as to whether " it suits the baby " ; the mother's milk will always be better than any substitute, and the fault must be sought elsewhere—in too frequent or too large meals, in bad management or infection of the baby.

The human infant has, happily, considerable powers of accommodating itself to the overtaxing of its digestive apparatus, but often there is rebellion in the shape of griping, wind, and vomiting, The gradual training of the digestive system has already been referred to (p. 254), and a consideration of the average amount taken by the normal infant in the first two weeks will illustrate nature's method. For the first two or three days an ounce or two of colostrum containing no curdy matter will be obtained, on the third and fourth days about 6 oz. of milk, and thereafter an increase on this of 1 or 2 oz. each day, so that by the end of the first week 12 oz. or thereabouts is reached. During the second week the increase is less rapid, $\frac{1}{2}$–1 oz. a day, so that by the end of the second week the full pint is not yet reached. The supply of milk will often exceed these averages, and many strong sucking infants will obtain considerably more and without harm to themselves. It is only here and there that trouble will arise, and for this reason the old maxim " to hasten slowly " is particularly applicable to the feeding of the young infant. The laudable anxiety to get back to the birth-weight and show a rapid gain is often the cause of a digestive upset, for which the mother's milk is blamed. The first maxim will be, not to force the pace at the start, but to prefer a gradual return to the birth-weight and a slow gain, rather than risk digestive disturbances. If the child is constantly crying and obviously unsatisfied, without other discoverable cause, then the quantity of milk obtained from the mother must be determined by test-weighings, and if below the averages given above, special measures should be taken to improve the supply from the breast, and supplementary feeding adopted only if absolutely necessary. The danger of all such additional feeding is that though at first it may supplement the breast milk, sooner or later it supplants it. Hence there must be good reason for adopting it, and it must be carried out in such a way as to minimize the risk of loss of breast milk.

The bottle feed must never replace the breast feed, but must be given after the baby has obtained all it can from the breast, otherwise the mother's milk will soon cease. The stimulus of sucking by the hungry baby must be kept up, as the human infant at once discovers that it can earn its living with less exertion through a rubber teat than from a bottle, and therefore, with an instinct acquired from its parents, gives up the harder work for the easier. Having now settled the method of giving the supplementary feeds, the more difficult problem arises as to the quantity and composition. The amount should be calculated so as to make up the deficiency of the breast milk, and yet be rather under than over the average requirement for a baby of the age, so that he is left on the hungry side, and thus encouraged to work hard at the breast. The quantity, then, will be the amount in humanized milk (p. 274) which will barely make up the deficit as shown by the test-weighings over twenty-four hours, diluted with two parts of boiled water, so as to avoid risk of digestive disturbance. Suppose, for instance, a child, ten days old, is found to obtain 10 oz. from the breast in the twenty-four hours, instead of about 15 oz., which would be about the average at that age, then with six feeds in the day an

extra ½ oz. of humanized milk after each breast feed would bring the total up to 13 oz. in the day, rather short commons, but probably sufficient for a start. As the two midday feeds would probably be the smallest, an ounce of humanized milk diluted might be given after each of them, another ounce after the last feed at night, when a full allowance is most needed in view of the long interval, and no addition to the other feeds. Larger supplementary feeds would only be adopted in the case of a big baby, or after the smaller one had proved insufficient.

If the supply of breast milk improves, the supplementary feeds would be diminished, by dropping first the one after the morning feed, as usually the greatest, and then the one after the next best yield, until perhaps only one was required after the breast feed which gave the smallest yield or after the last at night. Meantime, in order to encourage the flow of breast milk, means will be taken to stimulate lactation, by those general measures already mentioned, extra fluid, attention to diet, digestion, action of the bowels, and by special measures directed to the breasts themselves. These are chiefly hot and cold sponging and massage. The former is done with two bowls of water and a separate sponge or cloth in each. Each breast in turn being bathed first from the cold and then from the hot, changing quickly from one to the other. The breasts are then dried with a rough towel, being supported by one hand and rubbed from the outside towards the nipple. This should be done twice a day. The massage is really the expression of milk and complete emptying of the breast, and is done by the two hands working from the limits of the breast towards the nipple. The mother can after be taught to do this herself,[1] and if so, should be instructed to do it for a few minutes after each feed, especially in those cases in which the baby does not succeed in emptying the breast completely. Great attention must be given to producing the proper mental atmosphere—eliminating all idea of failure, removing all disturbing factors, and enlisting the mother's interest and co-operation so far as they can be aroused. Such measures combined with strict regularity and attention to detail, outdoor exercise and general hygiene will rarely fail to produce the desired result. The frequent complaint of mothers that "their milk left them when they got up" is often due to their ceasing to give the attention they did to the regularity of feeding times and the details of nursing, as soon as they are no longer under the supervision of the midwife, and are occupied with other household duties. Great care, therefore, must be taken to impress on the mother the absolute necessity of continuing the systematic methods on which she has begun.

By the application of similar methods to those described for deficiency of breast milk, it is possible to restore the function of the breast after weaning, after even as long intervals as six weeks, though success in this is difficult to obtain without taking mother and child into a Hospital or Home and having both under very close supervision. When breast-feeding has to be abandoned temporarily because of illness, every effort should be made by massage and expression of the milk, or the use of a breast pump, to maintain the activity of the gland, till the mother's health will permit of the more active stimulus of the sucking infant. Enough, however, has been said to show the midwife how much greater are the possibilities of promoting breast-feeding now that more attention and thought has been given to the subject. The midwife may rarely in her own practice be able to carry out these methods herself, but if she knows what can be done, and the agencies she can call upon for assistance, she can do a great service to the health of the nation by using this knowledge among the mothers who seek her help and advice.

For ordinary everyday work the midwife will depend on the signs of thriving in the infant (Chap. XXIV. p. 258), and should she not be satisfied as to its progress, further investigation is necessary and therefore advice must be sought. What "promoting breast-feeding" means to the midwife may be summarized as follows:—(1) The investigation and management of women during pregnancy with the object

[1] The mother should hold the breast in both hands with the nipple protruding between the first and second fingers of the right hand. The thumb should then be used to massage the breast downwards towards the nipple, steady firm pressure being applied against the ridge formed by the fingers under the breast. Practice soon proves that at about the level of the secondary areola pressure causes expression of the milk. It is often difficult to start the flow, but once a few drops of fluid are obtained, regular expression for a few minutes every three hours will cause gradual increase in quantity. The breast must be emptied each time.

of removing obstacles to successful breast-feeding. (2) The instruction of the mother during her attendance in the details of breast-feeding. (3) If the infant is fretful and constantly crying and this cannot be remedied at once by the correction of errors of management, or if the progress of the child is unsatisfactory, steps should be taken to get the daily yield of breast milk determined, and, if insufficient, measures adopted to improve the breast supply, and the question as to the need for supplementing it decided; this will mean either medical advice or help from an infant clinic.

In the event of the refusal or inability of the mother to breast feed, the duty is laid on the midwife of notifying the L.S.A. of each case in which it is proposed to substitute artificial for breast-feeding (Rule E 12 (*a*), E 22 (*f*)), and a form E 23 (*f*) is provided for that purpose, in which the date on which it was proposed to substitute artificial for breast-feeding is to be stated and the reasons for the change given.

That "half a loaf is better than no bread" holds good for infant feeding, and partial breast-feeding is far better than none. Every endeavour must be made to conserve what breast milk there is, and to make the most of it. If the supply cannot be made sufficient for the baby's needs, the next best thing is to continue mixed breast and bottle feeding for as long as possible. Both mother and infant get some advantage from it, and some breast milk is always in reserve, should the infant get digestive disturbance and require care, especially in those cases in which suckling has to be carried on throughout the hot weather.

ARTIFICIAL FEEDING.

Failure to breast-feed involves some substitute for the natural food, and as cow's milk will generally form the basis of this, some consideration must be given the differences between it and human milk. Those pages (13 and 16) of the Introduction dealing with food substances should be studied, and the constituents of cow's milk there given compared with those of mother's milk given on page 264. The chief differences in constitution and physiological properties may be recapitulated here, for the sake of convenience and emphasis.

The protein in both milks consists of caseinogen, which forms with the digestive juice (rennin) the curd, and soluble or whey-proteins (lactalbumin and lactaglobulin), which are left after the curd is removed and coagulate at a temperature above 170°. The fat is contained in the cream and white milk globules, and gives the white colour to the curd in which it is entangled. The carbohydrate is milk-sugar (lactose). The proportions of these substances in the two milks vary roughly as follows: The protein in cow's milk is nearly 4 per cent., in human milk nearly 2 per cent. The fat in both is approximately 4 per cent., the amount of sugar is larger in human milk, 6–7 per cent. instead of 4 per cent. in cow's milk.[1] The proportion of water is about the same in both, 87–88 per cent., but the percentage of salts in cow's milk is about three times that in human milk, and the reaction of the former is acid (at any rate within a few hours of milking), while the latter is alkaline. The nature and physiological properties also exhibit marked differences. Not only is the protein in cow's milk double that of human milk, the relative proportion of curd-forming protein to soluble protein differs in that the caseinogen in cow's milk is about 4 to 1 of soluble protein, whilst the reverse holds good in mother's milk. Further, the caseinogen in cow's milk forms big tough curd, whilst in mother's milk the curd forms light, feathery masses. The fat in human milk is in finer emulsion, whilst in cow's milk it is present in larger fat globules which more quickly float to the top of the milk as cream.

The simplest part of the modification of cow's milk is to bring the chemical constitution of the two into accordance, and when the percentages of protein, fat, and sugar in cow's milk are modified to correspond with those in human milk, it is

[1] To remember these percentages the following may be a help:
Taking the food constituents in the above order—protein, fat, sugar. In the cow, which walks on *four* legs, there is roughly 4 per cent. of each constituent. In woman, who walks on *two* legs, begin with protein at 2 per cent., add another 2 per cent., making 4 per cent. for the next constituent—fat—and another 2 per cent. for the next, making roughly 6 per cent. of sugar.

termed humanized milk. No amount of modification, however, of the milk of the cow or any other mammal can ever be anything but a base substitute for the mother's milk. The mere chemical composition is but one item in the specific qualities by which nature makes the milk of each species of mammal peculiarly suited for the young suckling it has to nourish, and our crude efforts to mimic nature will always lag far behind the real thing. Those qualities which make the substances easy of digestion and absorption by the suckling for which the milk is designed, and the other characteristics already discussed on page 263 are beyond any mere juggling with percentages. Happily, the human infant has considerable powers of adaptation, and so can accommodate itself to very considerable variations in diet, and has enough reserve power to succeed in digesting, assimilating, and excreting material that its organs were never intended to tackle. Many children, however, show in after life the strain to which they have been put in infancy, especially the feebler ones with insufficient reserve to overcome the additional tax on their physiological powers.

From what has been said as to the liability of the suckling infant to infection, and of the greatly increased dangers to which it is put by substituting a food teeming with bacteria and particles of dirt for that drawn directly from the nipple without chance of contamination, it will be clear that the greatest risk the bottle-fed baby runs is from intestinal infection. Long before it has begun to turn sour or ferment, dangerous chemical changes from bacterial processes may have taken place in the milk, hence the enormous rise in infantile sickness and mortality in warm weather, when bacterial action is most active. The " humanizing " of cow's milk is of minor importance compared to the absolute necessity of cleanliness and purity. The problem of artificial feeding is therefore best considered under headings : (*a*) The precautions taken to ensure purity and cleanliness ; (*b*) the composition of the food ; (*c*) the practical management of artificial feeding.

A.

The Precautions taken to ensure Purity and Cleanliness.

The first thing is that the milk itself must be the purest and freshest obtainable. Adulteration, the use of chemical preservatives, and contamination of any kind make milk dangerous to the baby. It should be obtained from a dairy of good reputation or a municipal depot, and should be whole milk not over twenty-four hours old. However good the dairy and however great care is taken in handling the milk, organisms are certain to be present ; and the next question is—ought the milk to be sterilized before the child gets it ? Some dairies take special precautions in collecting and distributing their nursery milk so as to reduce the chance of contamination to a minimum. The cows are tested to see they do not suffer from tuberculosis ; the udder is washed, the milker's hands washed and gloved, and the milk pail shielded from contamination from dust and dirt from the cow. The milk is rapidly cooled in refrigerators and drawn off into sealed bottles for distribution. By this means the risks of the specific diseases that may be carried by milk—tuberculosis, typhoid, and scarlet fevers, diphtheria—as well as the dangers of fermentation and other forms of bacterial action, are greatly reduced. Such nursery milk is expensive and difficult to obtain except in large towns, and its use is therefore limited. Other dairies put up sterilized milk in sealed bottles, so that it will keep for a long time, and is therefore especially valuable for voyages, but it, also, is not available for the humbler households. Unless certified Grade A milk can be obtained, the best plan is to sterilize the milk at home. The best apparatus for the purpose is the " Soxhlet," which can be obtained from most chemists or instrument makers. It consists of a tin boiler containing a " cruet " or rack to hold the bottles. The bottles have rubber caps with a metal clip to keep them in place. Generally, six bottles are used and filled with the appropriate quantity of the prepared food for the child ; the rubber caps are fitted on and the bottles placed in the cruet in the boiler. Water is poured in to a depth of two or three inches, the lid is put on, and

the water boiled for ten minutes and then allowed to cool down for another ten minutes before removing the lid. The rubber cap will be found to be sucked into the mouth of the bottle and will keep it air-tight. The supply for the twenty-four hours can thus be sterilized at once, and when the infant is to be fed, the cap is taken off a bottle and a rubber teat put on and the feed warmed to the body temperature. In houses where it is not possible to provide such apparatus the milk should either be boiled before use or, better, some attempt made to sterilize the feeds as in the Soxhlet apparatus. Boiling is the most effective and certain method of destroying organisms, but it coagulates the soluble albumins and takes away from the milk certain qualities of freshness ; still, it is the simplest and surest method of destroying all bacterial life, and the objections to it are trifling in comparison with the safety it brings. The chief objection is the loss of the accessory substances described on p. 14, and this loss must be made good by giving a teaspoonful of fruit juice or raw-meat juice once a day. Orange or grape juice is best, but the scrapings of apple or pear, or even of turnip or carrot, squeezed through clean butter-muslin will suffice. With a little sugar and boiled water, the fruit juice will be readily taken by the infant.

The simplest plan is to make up the feed for twelve or twenty-four hours, and place the bottle containing it in a saucepan of water so that it is half to three-quarters covered, and bring the water to the boil for fifteen minutes. This does not produce so much change in the milk as boiling it, and yet sterilizes it effectively. It can be done in any household, and, so long as care be taken in keeping the feeding bottles clean and in transferring the feeds to these bottles, will be effectual in preventing bacterial infection. This method would be still further improved by treating each feed this way instead of the day's feeds, but few working women, with their heavy household duties, could do this.

Pasteurization, in which the milk is heated to a temperature of 155° and kept at this for half an hour, is another method, but again not practicable in any household where there is not a skilled nurse.

But in addition to the care required in the preparation and sterilization of the food, equal care must be exercised in regard to the bottles and teats, otherwise all the precautions taken will be rendered useless. The simplest possible form of bottle is best. The old-fashioned bottle with a tube dipping down into the milk is happily rarely seen nowadays, and as it is extremely difficult to cleanse, it ought never to be permitted. The boat-shaped bottle is more generally seen—often with an opening at both ends, so that it can be washed through. The second opening is no advantage and the cap covering it is a possible source of contamination. The best bottles are the small bottles such as are described for the Soxhlet apparatus, and, when possible, two or three should be in use. The child feeds more slowly from them as there is no aperture for air to enter as the milk is sucked out, but this is no disadvantage, and by removing the teat from the baby's mouth now and then and allowing air to enter the bottle through the teat-hole, the child has no difficulty in emptying it. These small bottles are easily cleansed ; after feeding the bottles should be rinsed out with water with a little washing soda in it and afterwards scalded with boiling water or, preferably, boiled. The teats must be large enough to fit over the flange at the mouth of the bottle and should have an aperture just big enough to allow the milk to drop out slowly when the bottle is turned upside down. A good plan is to obtain several unperforated teats and make the perforations with a hot knitting-needle. The teat should be thoroughly cleansed after use, being turned inside out for the purpose, and rubbed dry with salt. Boiling the teat unfortunately makes them soft and collapsible so that they soon become useless ; but they must be scalded at least once a day. Strict cleanliness is necessary because the smallest particles of milk retained in the bottles or teats will suffice to infect the whole feed.

At the feeding-time the bottle is placed in warm water, and when the mixture, tested by a thermometer, is at 100° a clean teat is put on to the bottle, which is then held upside down to see that the milk flows. The teat is put in the baby's mouth, the bottle being held so that the teat and neck of the bottle are full of milk ; as the milk is sucked out, the bottle must be raised so as to keep the milk in the

teat and prevent air being sucked out of the bottle. The time taken over each feed and the quantity given should be as for natural feeding, except that it is well to go slowly at first till the child is used to the artificial food.

B.

Composition of the Food.

In working out the composition of the substitute mixture, two essential points regarding its suitability for the infant must be kept in mind; it must contain sufficient food material to meet the bodily requirements and growth, and it must be easily digestible and not overtax the powers of assimilation and excretion; in other words, it must be suitable to the infant's nutrition and digestion. Of these essentials, the latter calls for our particular attention at first, because, if the food is not properly digested, it cannot be assimilated and used for nutrition, and also, once the digestive functions are disordered, recovery will be slower than in the case of a child whose nutrition has suffered solely from insufficiency of food, provided this has not continued too long.

Hence it will be well to err on the side of safety by beginning cautiously with dilute mixtures, and to increase the strength as the digestive functions become established and we are able to feel our way by watching results. As the "caloric value" of humanized milk can be made near to that of breast milk, the best plan is to take that as a basis, and, though diluting it to begin with, to aim at getting the infant to take it throughout the period of suckling. Infants vary both in their powers of digestion and nutritional requirements, and hence no one mixture will suit all babies, but by taking humanized milk as our standard and making such modifications in it as may be necessary to meet individual and difficult cases, we shall, at any rate, make the one factor we can control, the percentage of various constituents in the milk, conform as closely as possible to the natural food. Indeed, our principle throughout will, so far as can be, to make the artificial imitate the natural.

Before considering the alterations to be made in cow's milk to adapt it so far as we can to the needs of the human infant, it is necessary to draw attention to the changes in the composition of milk after standing and after removal of the curd. The composition of cow's milk as given, is that of whole milk—the milk as it comes from the cow containing the full amount of cream; but if this milk is allowed to stand, the lighter fat globules rise to the surface as cream, so that the upper portion will in a few hours, show a percentage composition differing markedly from the lower. If a quart of whole milk is allowed to stand in a quart measure for six hours, the top 8 oz. roughly contain 3–5 per cent. of proteins and 10 per cent. of fat; if it is allowed to stand for eight hours, the top 6 oz. will contain 3 per cent. of proteins and 16 per cent. of fat, the percentage of sugar in both being slightly less than whole milk. Gravity cream, *i.e.* the fat which rises on standing, is usually reckoned as having a fat content of 16 per cent. Thick cream of double this strength can be obtained by the use of centrifugal separators, and the fat content of centrifuge or thick cream is roughly taken as 32 per cent. Whey, which is milk from which the caseinogen has been removed by curdling, contains practically no fat, as that is all enmeshed in the thick curd, but all the soluble protein (1 per cent.) and sugar (5 per cent.) is retained. It is necessary to keep in mind some rough idea of these figures, and to realize that, on standing, the whole milk will quickly alter in composition in its various strata, owing to the tendency of the lighter fat to float to the upper layers. This factor alone will easily lead to error, if the milk has stood for even a few hours, the upper or lower part alone used and the composition reckoned on the usual percentage of fresh whole milk.

Humanized Milk.—The old rough and ready method was the dilution of cow's milk with an equal part or with two parts of water. The former reduced the percentage of protein roughly to that of breast milk, and the extra dilution of the latter was in order to render it easier of digestion. These dilutions gave no approach

to the chemical composition of breast milk, as the percentage of fat and sugar was also reduced, with great diminution in nutritive value, and therefore the addition of cream and sugar was necessary to bring up the percentage of these constituents to somewhere near their proper proportion. These casual dilutions are too inaccurate for safety. A very simple method is to stand a pint of new milk for eight hours in a tall narrow jug, dip off the top 9 oz., dilute with 10 oz. of boiled water in which has been dissolved 1 oz. of milk sugar, and then add 1 oz. of limewater to make it alkaline. By standing the milk eight hours, the percentage of fat in the upper half is more than doubled, so by taking 9 oz. from it and diluting with 11 oz. of water, the fat content of the mixture is about 3·6, the protein about 1·5, and the sugar, nearly 7 per cent. When thick cream is available it may be found simpler to take ½ pint of whole milk, add 1 oz. of thick cream (32 per cent.), and make up the mixture to a pint by the addition of 9 oz. of boiled water, in which 1 oz. of milk sugar has been dissolved, with a pinch of bicarbonate of soda to make it alkaline. In this latter formula the protein content is slightly higher than in the one first given.

A more accurate humanized milk can be made by using whey, as well as water, as the diluent, because the relative proportion of soluble protein to curd-producing protein can be made to approximate more closely to that of human milk. The preparation of whey is, however, too difficult and complicated for ordinary use by mothers in district practice, though the midwife ought to be able to prepare it herself.[1]

Let us work out how this modification is done. Suppose a pint of milk is set for eight hours, and the top half is dipped off and put on one side, while the lower skim milk half is used to prepare whey. After the whey has been heated to 160° for five minutes to destroy the ferment, it can be added to the top milk, and the quantity made up to the original pint by the addition of boiled water, and either 1 oz. of limewater or a pinch of bicarbonate of soda. The protein has been reduced by the abstraction of rather over half the caseinogen (as the proportion of this in the upper half will be reduced by the excess of fat there), so that the mixture contains all the soluble and nearly half the curd-forming protein of the cow's milk, which will work out at about 2 to 2·5 per cent. of protein, of which 1 per cent. is soluble protein. The fat is reduced slightly in amount by what is removed with the curd, and the sugar will be about the same as in the original milk—about 4 per cent. The addition of ½ oz. of milk sugar will bring the percentage up to 6·5, and thus we will have a near approach to breast milk, except that there is a slight excess of protein. Suppose, therefore, we now take off only the top 7 oz., we will still have most of the fat in this portion. Then the remaining 13 oz. could be treated as before, and the whey so obtained added with ½ oz. of sugar in boiled water and limewater or bicarbonate of soda to make the whole up to the original pint. This results in the removal of nearly ¾ of the caseinogen of the cow's milk and brings the protein content down to just under 2 per cent., with the soluble and curd protein practically equal; the fat again is reduced somewhat by that enmeshed in the curd removed, and the sugar increased to 6·5 per cent. by that added, so that there is now a very close imitation of human milk. Moreover, in beginning bottle-feeding, this method allows of simple variations to meet difficulties with individual babies. The two constituents of cow's milk most likely to give trouble in digestion are first of all the fat, and next the caseinogen with its thick, tough curd. If the principle of the method has been grasped, it is easy to see how the fat content of the milk could be reduced to half by not setting the milk at all and taking 7 oz. of new milk instead of the top 7 oz. after the milk has been set for eight hours, then as fat tolerance in the baby developed the milk could be stood for an hour or two hours and so on, till in time it might be possible for the 7 oz. obtained after the six to eight hours' standing to be used. So also if there was intolerance to curd, less than the 7 oz. suggested might be dipped off, so that a greater proportion of curd would be removed from the milk which is converted into whey. It is certainly much better that the midwife

[1] *Preparation of Whey.*—A pint of skimmed milk is warmed to a temperature of 100°, a teaspoonful of rennet or essence of pepsin added, and allowed to stand till a firm curd forms. The curd is then broken up by stirring with a clean fork and separated from the whey by straining through muslin. The whey must now be heated to a temperature of 160° for five minutes to destroy the ferment of the rennet and rapidly cooled.

should understand some such system of " humanizing " cow's milk, and how it can be varied to meet special cases, than to learn off by heart milk formulæ, the precise meaning of which she has but a foggy idea. A simple formula for mothers unable to carry out instructions and with little in the way of accommodation and receptacles for setting milk is to add to 8 oz. of milk (thoroughly mixed), 12 oz. of water (of which one should be limewater), and a tablespoon each of milk sugar and thick cream or emulsion.

Other variations than in the actual food constituents are sometimes adopted with a view of trying to make the substitute more akin to breast milk in its physiological properties. The milk may be " citrated " by the addition of one grain of sodium citrate for each ounce of milk in the mixture, with the object of diminishing the size and firmness of the curds and making the milk more digestible. If sodium citrate is used, limewater should not be used to make the mixture alkaline, as the two counteract one another ; a small pinch of bicarbonate of soda should be used instead. Barley water and oatmeal water may also be used in the place of plain boiled water as diluent, not for any nourishment obtained from them, but for their mechanical action in preventing the formation of large curds. The objection to them is that the baby is not able to digest the starch contained, which sometimes causes diarrhœa, and that these starchy solutions ferment readily and must therefore be freshly prepared.

Other alternatives than humanized cow's milk may be adopted owing to circumstances, or for certain conditions of the infant. The midwife will not use such substitutes except on medical advice, but should have some knowledge of their composition and the reasons for their occasional use in infant feeding.

Peptonized milk is used only in cases of weakly or premature babies, when the power of digesting proteins is absent or very feeble. The milk is " predigested " before being used, and naturally is only a temporary means of tiding the infant over a dangerous period.

The best method is to make up the food mixture first and then peptonize the whole. It is then warmed to a temperature of 110° and a zymine or peptonizing powder added ; the bottle is stood in water at a temperature of 115° for fifteen to thirty minutes, shaking it now and then. After this the mixture is poured into a saucepan, brought quickly to the boil (to check further peptonization), and then rapidly cooled. The proteins are not peptonized fully in this time, but if the process is allowed to go further, the milk has a bitter taste and is not appreciated by the baby. Should there be any bitterness, a little cane sugar can be added to sweeten it. In special cases the predigestion may be continued for two or three hours.

Dried milks are those from which all the water has been abstracted and are useful in hot sultry weather when fresh milk may be difficult to keep or obtain. As cow's milk contains 12 per cent. of solids or about 1 in 8, 1 drachm of dried nearly corresponds to 1 oz. of whole milk, and therefore in humanizing dried milks a drachm should be used instead of an ounce of milk. There is no dried milk at present on the market which has been modified to conform to the composition of human milk. Dried milks have the great advantage of being able to be kept without risk of fermentative changes occurring and should be used during hot weather by those who have no satisfactory accommodation for storage.

Condensed milk is not a satisfactory food for infants, but among the poor is occasionally adopted of necessity. Condensed milk is milk concentrated to about four times the strength of fresh milk (25 per cent. of water), so that it has to be diluted with nearly three parts of water to make it correspond with fresh milk. Diluted to 1 in 5 it approximates to breast milk.

Some varieties of condensed milk are specially to be avoided, as the cream has been separated and the skim milk only condensed, and often cane sugar is added. The only forms suitable for infants are condensed " whole " milks, and of these the unsweetened (" Ideal," " Swiss," etc.) are better than the sweetened (" Nestle," " Milkmaid," etc.), except that the former goes bad more easily. A fresh tin ought to be used each day. Infants fed for long on condensed milk tend to become pale, flabby, and rickety.

Proprietary foods are not suitable for district work, as the best forms are

expensive and many of the others are very injurious. The infant cannot digest starch till nearly a year old, and therefore any food containing starch is certain to set up digestive disturbance and wasting. Also, there is a deficiency of fats in most of these foods, and that tends to produce rickets. The midwife ought to exert her influence with the mothers to keep them from using patent foods.

Some of the malted foods are useful in the feeding of infants suffering from digestive disturbance. They contain little fat, and are therefore valuable for temporary use when fats are not tolerated.

The midwife may frequently meet with cases in which the preparation of the humanized milk is beyond the capacity of the mother. She may have neither the accommodation, utensils, nor what is more serious, the intelligence to prepare a food which necessitates standing milk in a cool, clean place for eight hours, nor a tall vessel to stand it in, nor the care to dip off the top so many ounces. With such mothers the best that can must be done, but the endeavour should always be made to get the best out of them. When, however, it is clearly impossible to get anything more than the simplest modification of milk carried out, the preparation of the feeds may have to be reduced to the simplicity of taking ½ pint of milk and diluting it with ½ pint of boiled water in which an ounce of milk sugar (or ½ oz. of cane sugar) is dissolved. This food will be lacking in its due proportion of fat, and if 1 oz. of cream skimmed from the top of the milk cannot be used as part of the ½ pint of milk, the additional fat may be obtained by the use of cod-liver oil emulsion, New Zealand or Marylebone cream, or other fat emulsion which can be measured out in spoonfuls. Such mixture may then be put into a jug and boiled for fifteen minutes, cooled quickly, and kept covered in the most suitable place in the house.

The main difficulty of artificial feeding when cream is too expensive is the provision of a satisfactory fat, and in such cases a cod-liver oil emulsion, containing from 33 to 45 per cent. of fat, should be used instead, as its cost is barely half that of cream.

C.

Management of Artificial Feeding.

Now that the various methods of artificial feeding have been described, it will be well to discuss the simplest procedures for bottle-feeding in the houses of the poor, and especially the advice and instruction which the midwife can give to the mother. At this stage only the feeding of the full-time healthy infant will be considered.

The two essentials for such cases are—(1) Cleanliness; (2) simplicity. The instructions of the midwife must be such that the mother can easily carry them out.

(1) **Cleanliness.**—The necessity of a suitable bottle and the thorough cleansing of it and the teats must be impressed on the mother. The bottles with tubes are favoured by the poor, because the child can be left with the teat in its mouth to suck or not as it wishes. This must never be countenanced; not only is it dirty, but the temptation to fill the bottle and let the baby have it when it is troublesome is too great to be resisted. Whenever possible, two or three small bottles must be obtained and sufficient for a single feed only put in. The mother must be told to get the best milk she can obtain, and to sterilize the mixture either by boiling or, preferably, by placing the bottle containing it in a saucepan as already described. She must be warned against sucking the teat when it does not draw properly, or sticking a hairpin through the opening, or any other dirty process which may undo all the trouble taken to avoid contamination. Too much cannot be done by the midwife to impress on the mother the importance of strict attention to cleanliness.

(2) **Some simple feeding mixture,** such as one of those already described, should be adopted; a complicated system is useless. The child's progress must be observed and a watch kept for signs of disordered function, as mentioned in Chap. XXIV., so that some modification in the composition of the food may be made to meet the special requirements of the case. If the child is gaining weight, sleeping

well, and not crying or drawing up its knees as if in pain, if it is not sick and the motions are of the normal custard-like appearance, the child is thriving and the food suitable. If, after the bottle, the child always vomits part of it, it has either taken its food too fast or has taken too much. Care should be taken that a full fifteen to twenty minutes is allowed to each feed, and that the infant is at once put into its cot and left quiet. If, in spite of this, there is still vomiting immediately after feeding, the amount must be diminished—probably it is having too much at a time. If, on the other hand, the child does not appear satisfied, remaining awake after feeding, sucking its fingers and crying, probably it is not getting enough, and therefore another half-ounce should be added to each feed. If it continues to do well and is content, it will be evident that the short commons caused the discontent. If there are signs of indigestion and gastro-intestinal irritation—vomiting of sour matter and curds some time after feeding, colic and flatulence, as shown by the child crying and drawing up its knees as if in pain, and diarrhœa with green or frothy motions or the passage of curds—then the mixture is too strong and a more dilute one must be tried. If possible, however, the infant should not be kept long on too dilute a mixture ; as soon as the sickness and flatulence and passage of curds disappear, an attempt should be made to get back to humanized milk, and by substituting barley water for plain water or, better, by the addition of a grain of sodium citrate to the ounce of mixture, or by both, it is possible to diminish the size and firmness of the curd. In other words, the midwife must see how the child behaves with an average mixture like the one suggested, and alter it in the strength and composition and in amount to meet the special necessities of the case as need be. In order to guide the midwife further, the effect of too much or too little of the various ingredients may be noted as follows :

Protein.—(*a*) *Caseinogen or curd-producing protein in excess* and not properly digested will cause constipation with the passage of curds and formed masses in the motions ; also griping pain with flatulence and diarrhœa, with green, curdy and offensive motions containing mucus and often very irritating to the skin of the buttocks ; with the latter there may also be vomiting of sour, curdled milk, generally an hour or so after feeding—not immediately, as when the child has taken too much or too quickly. The modifications suggested by these symptoms would be—(1) For constipation and passage of curds—use barley water as diluent and add sodium citrate, diminish the amount of milk, and tentatively try to increase the amount of cream. (2) If there is gastro-intestinal irritation, *i.e.* vomiting, colic, diarrhœa, with passage of mucus and curds, it will possibly be necessary to put the baby on peptonized milk or a whey mixture or albumin water till the digestive trouble is better, and then gradually to return by easy stages to a stronger mixture. Such cases are difficult and require medical advice—if once signs of digestive disturbance occur, the midwife must not act alone.

(*b*) *The soluble proteins, lactalbumin*, etc., are much more easily digestible and are not present in sufficient quantity in milk to cause trouble.

(*c*) *Deficiency of protein* leads to loss of weight or very slow increase, to general malnutrition and rickets.

Fat.—(*a*) *Cream in excess* gives rise to indigestion and diarrhœa. There is vomiting of sour smelling, thin, curdy fluid about an hour after feeding ; the stools are frequent, large, and sometimes greasy from unabsorbed fat (soap stools).

(*b*) *Deficiency of fat* gives rise to the passage of hard powdery stools. The weight remains stationary and progress is slow.

Carbohydrates.—(*a*) *Excess of sugar* does not often cause trouble ; ordinary cane sugar is likely to cause vomiting and diarrhœa, if not used cautiously, and lactose in excess may cause green frothy motions and flatulence from fermentation in the intestines, with soreness of the buttocks.

(*b*) *Deficiency of sugar* leads to slow increase or loss of weight.

These are merely rough indications as to how digestion and nutrition may be affected by too much or too little of any one of the primary ingredients in the infant's food. It is, however, very difficult and often impossible to lay the blame on one, because once digestion is upset the toleration to all elements in the food s diminished. Commonly trouble arises from general over- or under-feeding. In

the former, digestive disorder predominates, and generally appears early; in the latter, malnutrition and lack of proper development, and naturally these effects take longer to manifest themselves. If indigestion does not arise from over-feeding the child will put on weight more rapidly than it should, because the excess will be stored up as fat and other tissue, but the limit to this storage-capacity is soon reached, the body metabolism shows signs of strain, and the child becomes ill. Its general condition deteriorates; it becomes pale and flabby, its tissues lose their firmness and become soft; there is often profuse sweating of a sour-smelling character; the urine is high coloured, and large offensive stools containing much mucus are passed. Unless remedied promptly this may lead to rickets and other nutritional disorder.

It must be remembered that want of cleanliness and bacterial fermentations are by far the most frequent cause of gastro-intestinal disturbance, with vomiting and diarrhœa and wasting. Green, offensive, and irritating motions are most often the result of bacterial action in the intestines. Hence the frequency of diarrhœa and vomiting in bottle-fed babies during hot weather when bacterial growth is most active. Therefore strict attention to the sterilization of the food is the most important matter in artificial feeding.

The duty of the midwife is plain. In accordance with Rule E 12A she will forthwith notify the L.S.A. that it is proposed to substitute artificial for breast-feeding, using the form (E 23 (*f*)) provided for the purpose. She will instruct the mother and endeavour to teach her the proper methods of bottle-feeding and watch how the baby progresses while under her care. If the child is not thriving, she will advise the mother to obtain medical assistance. A baby very rapidly goes downhill, especially with vomiting and diarrhœa, so no time must be lost. If the local authorities and health visitors pay special attention to all cases where the baby is being reared by hand, many infant lives may be saved. In accordance with the note appended to Rule E 12A, the midwife when she ceases attendance should advise the patient to avail herself of the help of local organizations for maternity and child welfare. Humanized milk is now so easily obtainable in many localities that much of the preceding instruction as to the simple home preparation of the baby's food may be unnecessary. The more accurately prepared feeds from such sources are naturally to be preferred when possible.

CHAPTER XXVI.

THE MANAGEMENT OF PREMATURE AND WEAKLY INFANTS.

The midwife is ordered by the C.M.B. to obtain medical help in the case of the child when there is "dangerous feebleness in a premature or full-time child," and she ought to interpret this rule very widely and advise that the doctor be called in for all premature and weakly infants. Their hold on life is a slender one, and they may die with very little warning and before a doctor can see them, and the midwife may then have awkward questions to answer before a coroner and his jury. But although the midwife ought not to assume sole responsibility in these cases of premature and feeble infants, she must have a good knowledge of how to look after them, and from the moment of birth treat them with special care.

By a premature infant is meant one born after the twenty-eighth week, when the child is considered viable, and before the fortieth week or full time.

The twenty-eighth week is really the earliest date at which the child has any chance of surviving, but very few born at that period of gestation will survive. On very rare occasions babies born even earlier than that have survived; allowing for errors in calculations, which will explain most of these cases, it may be said that instances of survival before the twenty-eighth week are much too rare to deserve consideration. They are infrequent and fortunate accidents.

Of babies born between the twenty-eighth and thirtieth weeks, the majority will die; under 20 per cent., and they the strongest and most carefully tended, will be reared. From the thirtieth to the thirty-second weeks, perhaps a third will survive, and from the thirty-second to the thirty-fourth, about half. After that the infant's chances improve rapidly, so that it may be said that those born a week or two before term run but little more risk than full-time babies. Indeed, when we get as near term as a couple of weeks there are so many other considerations to be taken into account, the weight and vigour of the child, and so on, that the slight prematurity of itself is of little account. It is for this reason that premature and feeble infants are considered together; a small, feeble baby, even if born at term, has to be treated like a premature baby, whilst a baby two or even three weeks premature, if of good weight and vigorous, may require no special care.

Evidence and Signs of Prematurity.—Careful calculation should be made from the mother's history. From that it may be found how many weeks short of the expected time the baby has arrived. Sometimes no definite dates are forthcoming, and, in any case, there are many possibilities of error. For this reason the signs of prematurity in the child must be looked for.

The child is small and wanting in the vigour of the normally developed infant; it does not kick or move its arms; the limbs are puny, the face wizened, with an "old-man" expression; the head and abdomen are disproportionately large for the size of the child; the skin is red and wrinkled because of the want of fat under it. The absence of the subcutaneous fat also gives the skin a transparent, waxy appearance, often showing the vessels underneath more plainly than usual. Soft, downy hair (lanugo) may be present on the face and body, and the nails may not be sufficiently formed to reach the finger-tips. The eyes are generally kept closed and the infant appears drowsy and lifeless. It has a feeble, whining cry, often cannot suck, and in extreme cases may not be able to swallow.

The length and weight give some idea of the degree of prematurity and the prospect of survival. The length from top to toe in inches is roughly half the number of weeks of development, *i.e.* at twenty-eight weeks the length is about 14 inches, at thirty-six weeks about 18 inches, and at term about 20 inches. Though the

length gives a better index of the degree of prematurity, the weight gives a better indication of the chances of rearing the child. Under 2 lb. the chances are negligible : not 5 per cent. of those between 2 and 3 lb. will be reared, even with extreme care ; of those about 3½ lb., 15 to 30 per cent. ; and when once 4 lb. is reached the chances of survival rise to nearly 80 per cent., and above 5 lb. they are little less than the average at term.

The premature infant is difficult to rear because of its lack of vitality, its inability to take and digest food, and the difficulty in maintaining its body temperature. Its organs and tissues are not ready to carry on their functions outside the uterus, and the want of the layer of fat under the skin makes it very susceptible to loss of heat.

What has been said of the premature infant applies also in some degree to weakly infants born at term. The vitality of full-time babies of 4½ lb., even 5 lb., is low, so that they require the same care as a premature infant. When the birth weight is below 5½ lb., more than usual care is required ; these children cannot bear much exposure or any considerable initial loss of weight without danger.

The causes of death in these premature and weakly infants are most commonly —lack of development and incomplete expansion of the lungs (atelectasis), undue exposure, leading to loss of body heat, collapse and heart failure, improper feeding, leading to digestive troubles, and various forms of infection.

Serious symptoms in these small babies are blueness and coldness of face and extremities—especially attacks of blueness (cyanosis) with rapid respiration—convulsive attacks, temperature below 95° or above 104°, sickness, severe jaundice, progressive loss of weight, and increasing inanition.

The treatment of the premature baby should be begun from the moment of birth, as the exposure which normal babies safely bear may prove very harmful. It should be wrapped at once in warm dry wool or flannel and, when the cord is divided, placed in a basket by the fire with warm bottles round it. It should not be bathed, so as to avoid the exposure and the cooling of the body after the bath, but should be cleaned with warm almond or olive oil. This should be done with the least possible exposure and in front of a warm fire ; the face and head can be done first, then the front and back of the trunk—the rest of the body being kept covered. The oil cleanses the skin beautifully and the oil remaining in the skin adds to its power of retaining the body warmth—takes the place, to a slight degree, of the layer of fat under the skin. The ordinary baby clothes should not be used and cotton wool only used at first. A separate piece of cotton should be arranged to go round the buttocks, so that this can be changed frequently without disturbing that round the upper part of the body or that round the legs. These latter need not be changed oftener than once in two days when the oil cleansing can also be done. A simple method is to place a layer of ½ to 1 inch of wool round the body and limbs, keeping it in position by bandages of thin muslin. A wool cap should be put over the head, leaving only the face visible. A knitted or flannel vest or slip can then be placed on the child, though this is not essential.

The difficulty of the premature infant in maintaining a normal temperature is so great that special provision has to be made for it. Something must be improvised, and the best thing is a small clothes basket or box, lined with wool or blanket, in which the infant can be placed and kept warm by hot bottles, which should be changed in turn to avoid any marked drop in temperature. An important point is to arrange the bottles so that they can be changed without disturbing or exposing the child. The basket should be covered with a shawl, turned back a little over the face to allow free circulation of air to the infant, and placed on a chair or table near the fire with a screen round it. The temperature in the basket should be about 95°.

The premature infant should be handled and disturbed as little as possible ; in the uterus it is protected from light, sounds, touch, etc., and the intrauterine conditions should be imitated so far as possible. The infant requires constant attention, so all arrangements as to feeding, changing, and so on, must be done with the minimum of disturbance.

Feeding.—(*a*) *Method.*—Very often a premature child is too feeble to suck, in which case a spoon or, preferably, a pipette or fountain-pen filler must be used.

A very useful special feeder is made of a glass pipette fitted with a small teat at one end and a rubber bulb like that on the fountain-pen filler at the other. This is filled like a pen filler, the teat put on and placed in the child's mouth, and then by gently squeezing the rubber bulb, the fluid can be slowly forced through the teat into the child's mouth without it having to suck or make any effort. This is much better than a spoon, as it can be done without disturbing the child in its cot. Great patience is required, as these tiny babies can only take their food extremely slowly.

(*b*) *Frequency.*—The stomach can contain little at a time, and eight or nine feeds in the twenty-four hours should be aimed at. Infants under 4 lb. may require feeding every two hours at first, and, to begin with, may not take more than 3 oz. in the day. Also it is necessary to begin feeding within a few hours of birth, as any loss of weight is a serious matter. Some authorities urge that the times of feeding should be as for a full-time baby, *i.e.* three-hourly with a long interval at night. This principle is sound in that the child's digestive functions are so far undeveloped that time is required for their education and that if they are disturbed it is extremely difficult to restore them. Further, if the infant's heat is maintained for it, little food material is required as there is little muscular activity. On the other hand, it may be difficult to get a feeble premature infant to take more than a drachm of fluid at a time, and therefore no absolute rule can be made.

(*c*) *Preparation and Composition of Food.*—The first essential is breast milk, but for the first few days a substitute is usually necessary. The greatest care must be taken in the sterilization and preparation of the food. To begin with, a very dilute food must be used, and its strength increased gradually as the infant's capacity to digest is gauged. Whey and cream mixtures are the best to begin with, and for the first day a 1 in 16 mixture will suffice. Take 3 oz. and 6 drms. of whey and add 2 drms. of 10 per cent. cream, making up 4 oz. of feed. Of this begin by giving 1 drm. every three hours ; during the second day give 2 drms., and try increasing the strength to 1 in 12 ;—take 4 oz. and 1 drm. of whey, add 3 drms. of cream to make it up to $4\frac{1}{2}$ oz., and see how much can be taken. In district practice 1 in 16 condensed milk may be used till lactation is established. By the third or fourth day there may be milk in the mother's breasts, and, if so, it must be expressed or drawn off with the breast pump and given, diluted somewhat if necessary, and about 3 or 4 drms. at a time. The only method of discovering the amount and strength of food which can be given, is to try with small quantities of weak mixtures and to judge by the weight and progress of the infant how far it is safe to increase the quantity and strength. If it shows signs of hunger by crying and is quiet again on feeding, it should be given more till it is satisfied and sleeps during the intervals. If it is not sick and its stools show it is digesting its food, it is safe to increase the strength tentatively. In difficult cases peptonized and diluted milk should be tried till the infant can take the mother's milk, or whey and cream mixture, or diluted cow's milk if there is no breast milk. Peptonized milk is probably the safest food for very premature infants until such time as the digestive functions is developed. It is therefore a good plan to begin with peptonizing the food for two or three hours and, by gradually reducing the time by 10 or 15 minutes each day, train the child to perform its own digestive duties by easy stages. In extreme cases, where the infant cannot swallow or is very difficult to feed, a soft rubber catheter is passed over the back of the tongue into the œsophagus and so into the stomach and the milk mixture poured into it through a glass funnel. Sometimes rectal injections of saline solution or sugar solution are useful, as the loss of fluid is an important factor in the wasting of these small babies.

As so much depends on the progress made, careful observations are necessary of the weight, temperature, nature of motions, and so on, and these must be obtained with the least possible disturbance of the infant. If reliable scales are available daily weighings should be made, but the gain will not be more than an ounce in two or three days, and therefore it is useless to disturb the child for this object unless a delicate enough apparatus is at hand. With less exact scales bi-weekly weighings must suffice. Naturally, no undue exposure can be permitted, and therefore the weighing must be done with the wrappings on the child and allowance made for them afterwards. The rectal temperature should be taken when the wool round

the buttocks is changed ; a low temperature is of serious import, and fever is often present during inanition and wasting. The presence of curd and undigested material in the stools is an indication for modification of the diet.

It is always worth while struggling to preserve the lives of these young premature babies, as eventually they may be as strong and well-developed as those born at term. Once it has assumed the appearance of the infant at term, the subsequent progress is in no way different, and it will grow up like any other child.

CHAPTER XXVII.

INJURIES, MALFORMATIONS, AND DISEASES OF THE NEWBORN INFANT.

Asphyxia Neonatorum.

This condition, in which the child does not cry or breathe when born, is the commonest birth injury. The term asphyxia literally means pulselessness, but it has come to be used for suffocation from want of air, and that is its meaning when applied to the newborn infant.

First, let us consider what causes the fœtus to breathe when born and thus become a child. The primary cause of the first breath is the excess of carbonic acid and want of oxygen in the blood (due to the gradual cessation of the placental respiration) stimulating the nervous centres for respiration, and the secondary cause is the reflex stimulation of the same centres by the cold air on the surface of the body.[1] Occasionally, if the fœtus is kept warm, and not stimulated after birth, it may remain some time without breathing and yet be of a good colour. The shrinkage of the placental site has not been sufficient to check entirely the maternal circulation to the placenta, the cord is pulsating quickly and strongly, so that it is in the same condition as it was *in utero* of receiving all the oxygen it requires from the placenta. As the retraction of the uterus and the separation of the placenta make an end of the placental respiration, the fœtus becomes cyanosed, carbonic acid accumulates in its blood, its respiratory centre is stimulated, and breathing begins. Should it not do so, it would pass into a state of true asphyxia. On the other hand, the stimulation of the respiratory centres may come into play before the fœtus is completely born, as described on page 171 in regard to breech deliveries, and blood, mucus, and liquor amnii may be sucked into the air passages by convulsive breathing efforts, thus producing another cause of suffocation.

The causes of asphyxia, or, if more advanced in degree, of stillbirth may be classified as follow :

1. **Interference with the placental circulation** by compression of the cord (kinks and twisting or compression between the head and pelvic wall), by separation of the placenta (placenta prævia, premature detachment), and by checking of the maternal circulation to the placenta from uterine retraction (protracted labour, tonic contraction).

2. **Premature inspiration** and suffocation by fluids sucked into the bronchial tubes ; this is really secondary and additional to the first cause.

3. **Injury to the brain,** especially pressure from rapid or excessive moulding during difficult delivery causing paralysis of the nerve centres. This always causes the advanced degree of asphyxia (white), because the respiratory centre will not respond to stimulation, or stillbirth. Except in difficulty with the aftercoming head, it will not often occur in cases which the midwife attends alone ; it is most common after difficult forceps operations (p. 306) and breech deliveries (p. 179).

4. **Maternal Intoxication,** from disease or drugs, as in eclampsia and other pregnancy toxæmic states, overdosage with chloroform, morphine narcosis, etc.

There are two varieties or degrees of asphyxia, the blue and the white, or if Latin is preferred, " asphyxia livida " and " asphyxia pallida." The latter is an advanced degree of the former, and the difference between them is that in the pallid asphyxia the deprivation of oxygen has been so prolonged that the nerve centres are

[1] Reference should be made to the pages in the Introduction dealing with respiration and reflex action (pp. 11 and 20).

paralysed by the excess of carbonic acid, hæmorrhage, or injury, and will no longer respond to reflex stimulation. In some cases the paralysis of the centres may be due entirely to pressure on the brain, and in many cases shock from birth injury is present as well as deficient oxygenation and increases the depression of the central nervous system. In the minor degree of blue asphyxia the livid colour is an indication of the excess of carbonic acid in the blood, but the heart is beating quickly and strongly, there is a firmness and muscular tone about the limbs and body, and the reflexes are still present, so that some external stimulation will quickly excite the respiratory centre to activity, breathing will commence, and the colour rapidly change to the healthy pink of well-oxygenated blood.

In the major degree of white asphyxia the child is a pale or grey colour, the heart is beating slowly and feebly, the limbs are flaccid and without muscular tone, and the head rolls about. The reflexes are absent, so there is no response to external irritation, and in advanced cases the pupils of the eye are widely dilated as in death, and the sphincters relaxed so that meconium escapes and a finger can be passed into the bowel without resistance.

As the distinction between these two forms of asphyxia is very important in treatment, it will be useful to consider the analogous case of a woman being anæsthetized with chloroform, which most pupils will have seen. When the patient is only partly under the anæsthetic, her limbs are rigid—the doctor often lifts up an arm to test this—and the reflexes are still active—a common way of testing this is to touch the eyeball to see if it produces closure of the eyelids. The patient may be quiet, but if the operation was begun she would kick or move—a reflex act, because she is unconscious and would not feel. When she is fully under chloroform, the limbs are flaccid and without muscular tone, so that an arm lifted up and dropped, flops down perfectly limp ; the reflexes are abolished, so that the eyeball can be touched without movement of the eyelids and painful operations done without reflex movements. Breathing is natural and the pulse is normal. Suppose, now, too much chloroform was given. The nervous centres would be paralysed by chloroform poisoning. The pupils of the eye would become widely dilated from relaxation of the pupillary muscle ; breathing would become shallow and then cease, and finally the heart would stop from paralysis of the cardiac centre. There are thus two degrees of anæsthesia—a light degree often used in midwifery and known as the obstetrical degree, when the woman is merely unconscious and sleeping but still retains her reflexes, so that during labour the stimulation of a pain will cause her to bear down ; and a deep degree, known as full or surgical anæsthesia, when the reflexes are entirely abolished, so that she does not bear down with the pains and so that an operation can be done without her moving. The minor degree of obstetrical anæsthesia, which may be said to correspond to the blue asphyxia, is often used to mitigate the expulsive pains of the second stage and save the perineum ; the major degree of full anæsthesia, which corresponds to the beginning of white asphyxia, is necessary for forceps and other obstetrical operations requiring complete relaxation of muscles and absence of reflex movement. When too much chloroform has been given, so that breathing stops, a condition like advanced white asphyxia is produced ; not only are all reflexes absent, but the pupils are widely dilated and the respiratory centre is paralysed. Artificial respiration must be carried out till the nervous centres recover and natural breathing recommences. This illustration should make clear the significance of the loss of reflexes and paralysis of the nerve centres and indicate the lines of treatment.

Treatment.—*Preventive.*—The incidence of asphyxia may be greatly lessened by good midwifery practice and careful observation to detect early signs of fœtal distress (p. 195) during labour. Antenatal supervision and the rectification of malpresentations and misfits so as to minimize interference will do much. The avoidance of force in hastening delivery and choice of methods will also help, such as pushing out rather than pulling out the aftercoming head (p. 173), should assistance be necessary. The blue cases practically always recover. So long as the cord is pulsating, it should not be cut. The mouth and nose must be cleared of mucus with a soft handkerchief or a piece of lint on the finger—the fœtus being first held up by its feet to cause the fluid to gravitate to its mouth. If breathing does not start, some method

of reflex irritation must then be adopted to excite the respiratory centre. The most effective are rubbing up and down the spine, sponging the head and chest with cold water, and putting the little finger into the anus. Holding the tongue with a piece of gauze and giving slight tugs on it fifteen to twenty times a minute is a very active stimulant to respiration. If it does not respond to this treatment it must be separated from the mother and treated as a case of white asphyxia.

Active treatment.—It is recognized nowadays that beyond clearing out the air passages little active treatment is required save in the most serious cases. A warm bath, rest, and gentle handling are of great importance, and artificial respiration is necessary only when these simpler procedures are ineffective.

In white asphyxia treatment must avoid roughness and be directed towards—

1. Clearing the air passages.
2. Carrying on respiration till breathing is established by the recovery of the nervous centres.
3. Stimulating the circulation and combating the state of shock which is present in these pale limp babies.

1. The importance of **clearing the air passages** is obvious: if they are blocked, air cannot get to the lungs, and more than that, the first inspiration will suck fluids from the mouth and upper air passages farther into the chest and possibly into the lungs. Separate the child and lay it on its back in a warm blanket on an assistant's knee, or on the bed or a table, with its head hanging down over the edge; press the chest gently with one hand, beginning from below upwards, and with the other stroke the windpipe from the root of the neck towards the jaw. This will cause the fluid to gravitate towards the back of the throat; wipe it out with a piece of lint on the finger and squeeze it out of the nose. Another thing to do is, after working the fluid up the windpipe, to compress the trachea between the finger and thumb just below the jaw, and while doing this put a handkerchief over the child's mouth and blow gently into it; the mucus will be blown out of the nose, while the fingers on the trachea prevent it going down towards the lungs. Where there is a great deal of mucus it may be advisable to pass a catheter into the trachea; this requires a special catheter with a bulb on it into which the mucus is drawn. It ought to be passed 3 or 4 inches from the lips, and the best method of passing it is to put the forefinger of the left hand into the child's mouth, well behind the tongue, and with the thumb outside to get the larynx (Adam's apple) between the finger inside and the thumb outside. Then with the right hand pass the catheter to the finger behind the tongue, which will guide it forwards in the direction of the thumb of the left hand and so through the larynx and down the trachea. If a mucous catheter is not available, a male gum elastic one can be passed in the same way. In this case, mucus and other matter from the genital tract may be sucked up into the mouth of the operator, and, therefore, the better plan is to blow down the catheter and blow the mucus up out of the trachea; the chest or the trachea just above the breast bone should be compressed while doing this, and so make it difficult for the mucus to go down.

2. **To carry on respiration till natural breathing begins** means the adoption of some method of artificial respiration. Those in most common use are the following:

(*a*) *Sylvester's.*—The child is best wrapped up and on an assistant's knee in front of the fire, lying on its back and with its head hanging down over the knees. The assistant must hold the feet. The midwife, sitting in front, takes hold of the forearms and, keeping them taut, draws them out and up over the child's head, turning the hands outwards (everting them) all the time until they meet and cross over the back of the head. This opens the chest and draws air in. The arms are then brought down and pressed into the chest so as to squeeze the air out and to produce expiration. This should be done about twenty times a minute. Care must be taken to see that the tongue does not fall back; it must either be drawn forward with gauze or forceps or the angle of the jaw held forward, as is done with the anæsthetized patient in whom the same thing is likely to happen. By this method a large quantity of air is drawn in and out of the lungs and can be heard going in

and out, but it requires assistance and cannot be done single-handed, and is not easy to carry out when the child is in a bath.

(*b*) *Byrd's method.*—The child is supported by the hand by the middle of the back and the head and legs allowed to fall down, producing expansion of the chest and inspiration ; the shoulders and buttocks are then grasped in the hands and the child doubled by squeezing the two ends of the child together and so causing expiration. By this method there is not the same air entry as in Sylvester's method, but it can be done single-handed and with the child in a bath.

(*c*) *Buist's method.*—The child lies on its back on the left hand of the operator, with the head and legs hanging down—the child's feet towards, and its head away from, the operator. The chest is thus expanded and inspiration occurs. The child is then gently thrown over to the right hand and turned over, so that its chest is supported in the palm while the head and legs hang downwards, thus driving air out of the lungs ; the chest is squeezed at the same time to empty it more completely, and then the child is tossed back on to its back on the left hand.

Mouth to mouth inflation is not a method of artificial respiration, but a means of artificially inflating the collapsed lung preparatory to adopting one of the methods of artificial respiration. It is carried out by placing a cloth or gauze over the child's mouth and putting the mouth over its mouth and blowing through the cloth. The fingers on one hand should press firmly on the region of the stomach, and the fingers

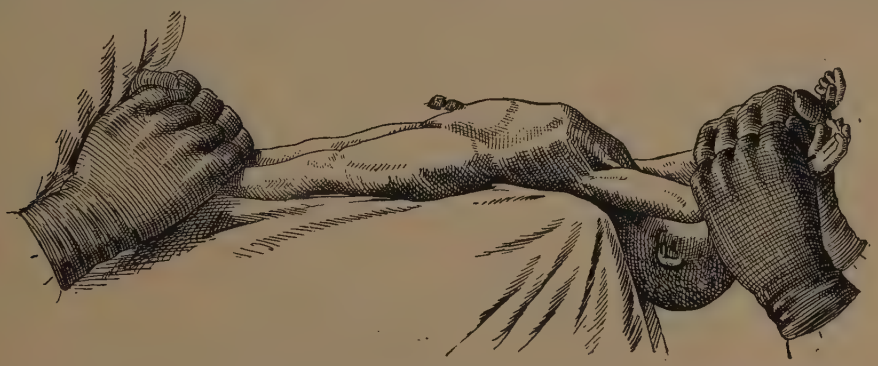

FIG. 109.—ARTIFICIAL RESPIRATION: INSPIRATORY MOVEMENT (Sylvester's Method).

The child is lying on the knee of an assistant who holds its feet. The hands are carried up over the child's head by the midwife sitting in front. The child is left uncovered to show the position of the head and body.

of the other should partially, but not completely, close the nostrils ; indeed, for the first blow or two, it is best to leave the nostrils open to allow of the escape of mucus, and then to blow once or twice with the nostrils slightly closed. The hand with the fingers downwards should be laid on the left side of the chest so that the fingers can press up under the ribs in order to lessen distension of the stomach by air. By expanding the air vesicles of the lung, mouth to mouth inflation relieves the strain on the heart. In asphyxia, the right side of the heart is engorged with blood which cannot get through the collapsed lungs. As soon as the lungs are blown up, the block in the circulation is greatly diminished and the heart relieved. The fingers pressing on the stomach will often notice the heart, which could scarcely be felt, make several strong beats after each inflation. This method is a very valuable measure preparatory to artificial respiration.

3. **Stimulation of the circulation and treatment of shock** is carried out first of all by the application of warmth. The importance of avoiding violence is such that many authorities now advocate warmth and rest without artificial respiration. The intermediate course is advised of trying first rest, warmth, and stimulation, and if no respiratory effort is made, then combining immersion of the child in a hot bath (temperature 105° F.) (a little mustard in the bath is useful) with artificial respiration (Byrd's method), started and carried on while the child is in the bath ; afterwards it can be taken out of the bath, dried, and wrapped in a hot blanket, and artificial respiration (Sylvester's) continued in front of the fire. A little brandy

on the finger should be put on the back of the throat and the child put back in the bath at intervals. The faintness and feebleness of the circulation make the application of cold water and smacking of the pallid babies bad practice.

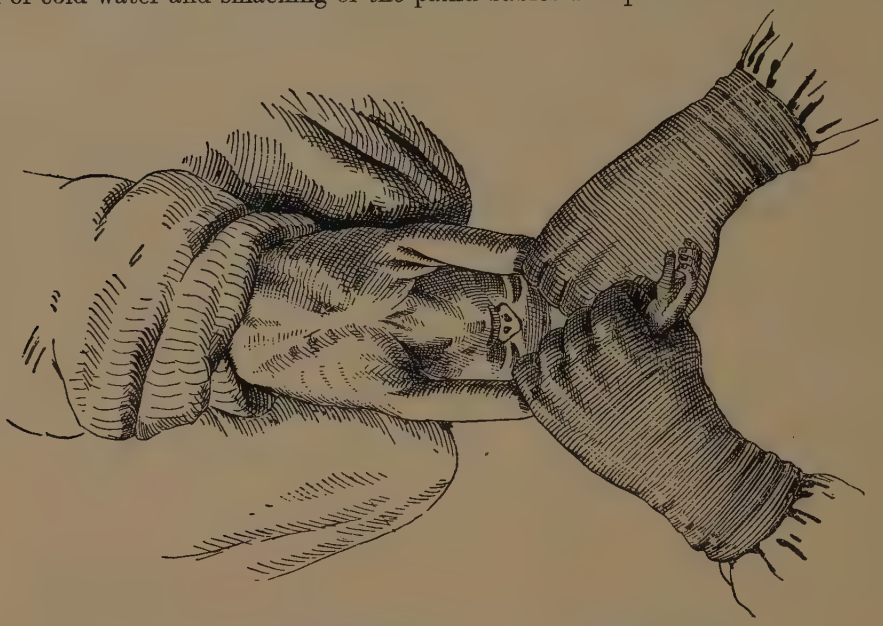

Fig. 110.—End of Inspiratory Movement (Sylvester's Method).
The arms drawn up and crossed over the child's head.

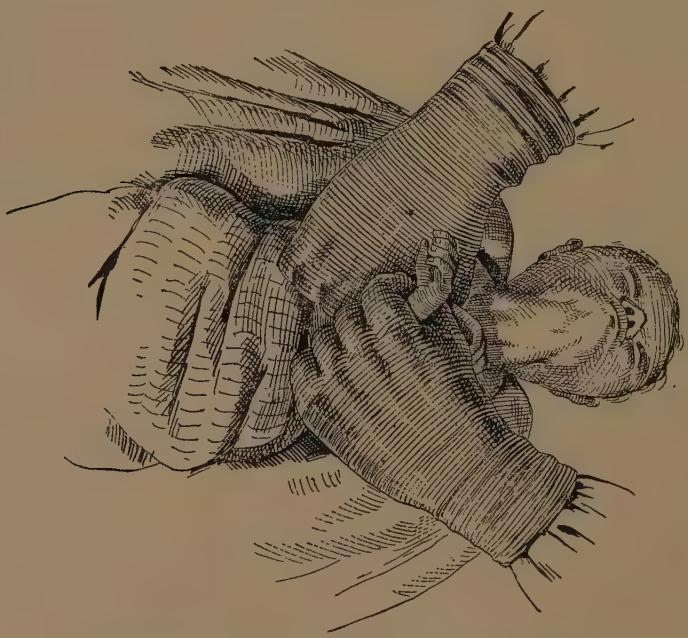

Fig. 111.—Expiratory Movement (Sylvester's Method).
The arms are brought down crossed and the elbows pressed in to the chest.

The essential points in the treatment of asphyxiated babies may be summarized thus :

Unless the fœtus at birth is obviously dead, macerated for instance, the measures for its resuscitation must be begun at once if it shows no sign of crying or breathing. The rules of the C.M.B. order that, " in the case of a child born apparently dead,

the midwife must carry out the methods of resuscitation which have been taught her" (E 15). If the heart is beating well—forcible pulsation of the cord is the simplest indication of this—and the fœtus is blue, and the neck and limbs not flaccid,

FIG. 112.—INSPIRATORY MOVEMENT (Byrd's Method).

The child supported in the hand by the middle of the back so that the head and legs fall down on each side. This causes air to be sucked into the chest.

start the simple measures for blue asphyxia before dividing the cord. If they do not succeed, and the pulsation in the cord is becoming slower, cut the cord, place the fœtus in a warm bath and apply cold water to its head. If that is unsuccessful,

FIG. 113.—EXPIRATORY MOVEMENT (Byrd's Method).

The shoulders and buttocks grasped in the hands and the child doubled up, thus squeezing the air out of the chest.

allow a little blood to flow from the cord and start artificial respiration. If the body is blue but the face pale, and lips grey, and the head flops about, and the pulsation in the cord is scarcely felt, cut the cord at once, clear the air passages, and inflate the lungs. Place it in a hot bath and begin artificial respiration. Should the child

begin to gasp, be careful to time the movements so as to help the natural efforts, and do not squeeze air out just when the child is attempting to draw it in. Continue artificial respiration in front of the fire, with occasional return to the hot bath, and watch carefully for signs of life. The pulsations of the heart may be few and far between, but so long as there is any sign of life, persist with treatment. If in the course of half an hour no heart beat, however feeble, has been felt and there is no sign of respiratory effort, the case is hopeless ; it must be remembered that many wonderful recoveries are made by patient continuance of efforts at resuscitation. When once the child begins to breathe, put it in a hot bath and apply a cold sponge to the head only—that may cause it to take a deeper breath and begin to cry.

Once the child is breathing, it is not out of danger. These children should be kept very quiet and allowed to rest without disturbance, but under careful watch ; they are liable to attacks of cyanosis and heart failure—for these a hot bath and brandy are the best remedies—and to a form of inhalation pneumonia from matter drawn into the lungs.

Hence, though the midwife must at once devote all her attention to restoring the child, she ought to get medical help when possible, and always when the infant has only been restored with difficulty, is evidently suffering from " dangerous feebleness in a premature or full-time child " (C.M.B. Rules, E 21 (5)), and may die at any moment. She must also remember another rule (E 17) : " On the birth of a child which is in danger of death, the midwife shall inform one of the parents of the child's condition."

Injuries.

Cephalhæmatoma is a soft boggy swelling which appears on the child's head some hours—more usually a day or so—after birth. It is due to an effusion of blood between a bone or bones of the skull and the lining membrane (pericranium), possibly caused by pressure or injury during delivery, though often the labour has been easy and rapid so that no adequate reason for its occurrence can be given. As the pericranium is attached to the edges of each bone, the swelling is confined to the affected bone or bones and therefore never crosses a suture. If the fingers are placed on the swelling, it fluctuates, *i.e.* moves up and down with the pressure of the fingers like a rubber water-bag, thus showing its fluid contents. The swelling takes a long time to disappear, six to eight weeks, and may become hard at the edges from clotting of the blood, the central part remaining soft. The swelling commonly forms over the parietal bones—more often the left, as in first vertex positions it is posterior and more exposed to pressure from the sacral promontory—and sometimes two swellings are seen over both parietal bones. It does not affect the child, and causes little disturbance, and therefore calls for no treatment unless very large and causing pain, in which case cold compresses should be applied and medical advice obtained. It is most likely to be confused with a meningocele (p. 292), a tumour formed by a hernia-like protrusion of the brain membranes through a gap in the bones of the skull. A meningocele has the same fluctuating feel, but protrudes more markedly, becomes tense when the child cries, and sometimes pulsation can be felt in it. Also it does not occupy a bone like the cephalhæmatoma, but more often comes through a gap between two bones. It is a rarer and

Fig. 114.—Cephalhæmatoma of the Right Parietal Bone.
(From a Photograph.)

more serious condition. It is said that the cephalhæmatoma can be confused with the caput succedaneum, but this is very unlikely. The caput is present at birth and disappears in a few hours, whereas the hæmatoma tumour appears some hours after birth and does not disappear for many weeks. Also the caput is more diffuse and does not fluctuate. If there was any difficulty in diagnosis, a few hours would soon decide the matter.

Fig. 115.—Birth Injuries after a difficult Forceps Delivery in a Case of Contracted Pelvis.

(From a Photograph.)

A pond fracture is well seen over the left frontal bone. A hæmatoma of the ear and an abrasion of the skin in front of the ear are also present.

Fracture of the skull bones, or more often a pond-like depression, may be caused by severe pressure against the promontory. It is unlikely to occur in any case in which the midwife would be in attendance alone, but if found medical help must be obtained at once as hæmorrhage may occur inside the skull or the brain may be injured. Injury to the brain or intercranial hæmorrhage may result from difficult labour, especially in a flattened pelvis; the child is usually born in a state of white asphyxia (p. 284) with the heart beating but no attempt at breathing. If there are no signs of brain injury at birth, or if the child is resuscitated, evidence of intracranial mischief may arise in the course of a few hours or days. Paralysis of limbs, or twitchings going on to convulsions; rigidity of limbs; vomiting; constant screaming, and extreme irritability on being touched point to injury to the brain.

Fig. 116.—Facial Paralysis as the result of Forceps Delivery.

(From a Photograph.)

The left facial nerve has been injured so that when the child cries the left side of the face does not move. The mouth appears drawn over to the right side and the left eye remains open.

There is also a small cephalhæmatoma of the left parietal bone.

Fractures and dislocations may occur in difficult deliveries—the jaw may be fractured or dislocated in delivery of the aftercoming head, the collar bone may be broken with impacted shoulders, the arm or leg in difficult breech cases, and so on. The injury will generally be noticed at once by the child screaming when the part is touched or moved and by its not moving the limb so that it appears paralysed. Later there will probably be swelling about the injured area.

Nerve Injuries may occur—the facial nerve, commonly as the result of forceps delivery, in which case the midwife will notice that one side of the face does not move, and that the mouth is drawn over to the other side. This is especially noticeable when the child cries. The eye also cannot be closed completely on the affected side, and the child may not be able to suck properly and

require spoon-feeding. The condition generally improves and very rarely is there any permanent disfigurement. Sometimes the nerves of the arm are injured in applying traction to the axilla or in delivering the aftercoming head, and paralysis of the arm may follow. This is much more serious and is likely to be followed by permanent weakness.

Muscles are much less often torn—occasionally the sterno-mastoid muscle in the neck is injured in applying traction to deliver the aftercoming head, and, if so, a swelling will appear, and the child will cry when the head is moved. Other injuries may be caused during artificial respiration. The rule of the C.M.B. is quite distinct, that all injuries received during birth necessitate the midwife advising that medical help be obtained. When the arm or shoulder has been injured, the flexed arm should be lightly bandaged to the chest with the hand near the opposite shoulder till seen by the doctor.

Malformations and Deformities.

Few of these require even mention. Gross malformations and monsters are rare. Double monsters and conjoint twins are rare and few survive. They may give rise to great difficulty in diagnosis and in delivery. Congenital sacral tumours may form large masses difficult to recognize and possibly causing obstruction in labour. Sometimes general enlargement of the fœtus, gigantism, is present without other malformation and may cause great difficulty in labour ; it is liable to recur in the pregnancies of one patient.

Head.—Swellings due to protrusion of some part of the brain or its membranes (meningocele and meningo-myelocele) between or through the bones may give rise to difficulty in the diagnosis of the position at the beginning of labour and to difficulty during the labour. They form soft swellings on the head which may be noticed to become more tense when the child cries and sometimes the pulsations of the heart can be felt in them. All the midwife can do is to protect them from injury and report the matter to a doctor. Sometimes there is a gap in the spinal column through which some part of the membranes, or membranes and spinal cord, protrudes (spina bifida). These spinal meningoceles form a rounded swelling over the backbone, and must be treated like the head protrusions. Spina bifida is not uncommon with hydrocephalus or water on the brain. The hydrocephalic head has been mentioned as a cause of obstructed labour. The head is very large and softer than it should be ; the fontanelles and sutures are wider than normal, and sometimes the bones can be made to move on one another. In anencephaly the vault of the skull and brain are absent ; the presentation is usually by the face, but if the exposed base of the skull presents, the irregular bony surface may be puzzling to the examining finger. The body is sometimes large and difficulty may be encountered in the delivery of the shoulders.

Perhaps the commonest of all deformities in this region are *hare-lip* and *cleft palate*, which often go together, though each may occur alone. In hare-lip the upper lip is divided by a cleft which may run up into the nose ; in cleft palate the roof of the mouth is split from the uvula forwards to the front teeth, joining the hare-lip. The split in the palate leads through into the nose. In these circumstances the infant cannot suck. The breast milk must be drawn off and given by spoon or an artificial food prepared. Special teats are made with a rubber flap (obturator) to go over and close the cleft in the palate, but they are difficult to adjust. A doctor should be consulted as to the management of these babies. An operation will be necessary to close the palate and lip. *Tongue-tie* is a condition which exists more often in the imagination of ignorant mothers and nurses than in reality. The trained midwife will know better than attempt to interfere with the infant's tongue even should she think it is not right, and will refer the matter to a doctor.

Rupture at the navel—umbilical hernia—is due to the bowel pushing out the umbilicus and forming a swelling there, more marked when the child cries. This also must be referred to a doctor. The common method of treatment is to make a pad on the binder—often done by covering a counter or large bone button and sewing it on to the binder—and so arranging it that it covers the navel and keeps back the protruding bowel, or a pad and strapping may be used.

Ruptures in the groin—inguinal hernia—also occur; in a male child the bowel may come down into the scrotum.

The most serious malformation in connection with the bowel is **imperforate anus** or **rectum.**—This means that there is no exit from the bowel, so that it is completely obstructed. At birth the anus should be examined to see that it is normal, and if no meconium has been passed in a few hours, the little finger should be oiled and gently passed in to see that there is a proper passage. If there is not, an operation will be required.

Prolapse of rectum shows itself by the protrusion of the red mucous membrane of the bowel through the anus. It should be gently replaced by pressure with wool or soft rag and medical advice obtained without delay.

The **genital organs** may be malformed, but unless there is some obstruction to the passage of urine, nothing is likely to be done till the child is older. Such obstruction is rare, but occasionally there may be difficulty in male children owing to a tight foreskin (phimosis). If there is difficulty, the foreskin should be drawn back and an effort made to stretch the opening, and the matter should be reported to a doctor, as circumcision may possibly be required. Continuous straining to pass water may lead to hernia.

Club-foot and other deformities of the limbs should also be seen by a doctor while the baby is quite young. The mother should be told to take the child to the hospital or to a doctor so as to get instruction in the manipulations to counteract the deformity. Birth marks, hairy moles, nævus, and other conditions which are improved by treatment also call for advice while the child is young.

The rule of the C.M.B. is that any malformation or deformity endangering the child's life should be reported to the doctor. From what has been said above it will be seen that some, such as cleft palate, imperforate anus, and rupture, should be seen to at once. Deformities of the limbs should be shown to the doctor, as soon as the mother is able to get about.

Infection of the Eyes.

Ophthalmia Neonatorum.—This is the inflammation of the eyes of the newly born due to infection at birth from a vaginal discharge in the mother or to infective matter introduced after birth through dirty methods or carelessness. The first part of the eye to be involved is the conjunctiva—the red membrane lining the inner surface of the eyelids and passing on to the white surface of the eyeball—but in bad cases the transparent seeing part of the eye (the cornea) may be involved, and even the interior of the eyeball. If the clear part of the eye is involved, milky patches are produced which interfere with the sight and may cause blindness; if the cornea is perforated and the infection obtains entrance to the eyeball, the eye is totally destroyed and generally collapses.

In the majority of birth infections the infective agent is the gonococcus—though other pyogenic organisms may be the cause—and the disease appears within the first day or two of birth. If no sign of trouble in the eyes is present till the fifth day or later, the infection must have been introduced through dirty methods in nursing the child.

Symptoms.—The first thing noticed is a straw-coloured watery discharge from between the eyelids causing them to stick together. It dries into a yellow crust along the margin of the lids. The child keeps its eyes closed because the light irritates the inflamed conjunctiva. The eyelids become red and swollen, so that it becomes difficult to open them sufficiently to see the eye, and the discharge becomes profuse and purulent. If the eyelids are opened the conjunctiva will be seen to be swollen, very red, and exuding matter freely.

Treatment.—*Preventive.*—In all cases in which a discharge is noticed in the mother special treatment for this should be adopted. Medical advice must be obtained in all cases of vaginal discharge noticed during pregnancy or at the commencement of labour, according to the rules of the C.M.B., but should the midwife find her patient well on in labour and suffering from a purulent discharge, an ante-

partum vaginal douche of perchloride of mercury 1 in 3000 should be given if the head is not too low and special precautions taken in the treatment of the child's eyes. The eyes should be wiped with a piece of sterile wool as soon as the head is born. A separate piece is used for each eye and all vernix and adherent matter carefully wiped away from the edges of the lids before the eyes are opened. Some authorities recommend swabbing with pledgets of wool soaked in perchloride of mercury solution (1 in 1000 to 1 in 3000), but the objection to the use of fluid is that infective matter may be washed in between the eyelids : if wool swabs from percloride lotion are used, it is better to squeeze them dry before wiping the eyelids. In this way the antiseptic action of the chemical solution is obtained without the risk of washing matter into the eyes. In all cases in which vaginal discharge is present in the mother, or in which it is known there has been gonorrhœal infection, the eyes of the infant ought to be irrigated after birth. The washing of the baby must be carefully done so as to avoid infection by bath water containing the material washed off the body. In these suspected cases it is best not to bath the child at all for a few days, but to wash it on the nurse's knees. The head should be washed first and very carefully, and the eyes, nose, and mouth thoroughly cleansed with separate pieces of wool or lint, after washing the head the rest of the body should be done. If a bath is given, the head should be washed first and the body washed in the bath, the child being supported so that no bath water gets near the face. In any case, after the first washing a drop of antiseptic solution should be instilled into each eye. The best solution for this purpose is one of the silver salts—protargol (5 per cent.) or silver nitrate (2 per cent.) ; but these solutions, unless freshly prepared, are likely to be inert, and therefore a weak perchloride solution (1 in 4000) may be used as a substitute, but only when reliable silver solutions are not available. From the moment of birth the infant's hands should be wrapped up so as to prevent the eyes being rubbed.

Treatment after Infection.—Should discharge and redness and swelling of the eyelids show that infection has occurred, the midwife neglects her duty if she does not at once get medical advice and scrupulously carry out the instructions given her. The C.M.B. Rule [1] is that medical help is required in "inflammation of, or discharge from, the eyes, however slight" (E 21 (5)). Frequent cleansing of the eyes is essential—the discharge must not be allowed to accumulate under the eyelids ; constant irrigation of the eyes with some mild antiseptic lotion, which will be prescribed for the purpose (generally boracic lotion or very dilute perchloride of mercury), is almost always ordered, and in bad cases it may have to be used hourly or even oftener. In such cases it is well to anoint the edges of the eyelids with some ointment to prevent them adhering and so retaining the secretion and to swab away the discharge with bits of wool. Great care must be taken in all these manipulations to avoid causing any abrasion of the surface of the eye, as it may be the starting-point of an ulcer and go on to perforation of the eyeball or leave a milky scar on the eye. If only one eye is affected, great care must be taken to avoid infecting the sound eye. A pad should be kept over it when the other eye is being dressed, and the child's hands should be secured so that it cannot get them to its eyes.

In a foot-note to the Rule quoted above the C.M.B. gives the duties of the midwife in a case of infection of the eyes as—

(1) To call in to her assistance a registered medical practitioner, using for this purpose the form for medical help (see Rules E 20 and 23 (*a*)).

(2) To send notice to the Local Supervising Authority that medical help has been sought (see Rules E 22 (1) (*a*) and 23 (*a*)).

The midwife must not forget that the disease is extremely contagious, and that any carelessness on her part may result in her inoculating her own eyes or those of other babies or patients in her charge. The contagion is very readily transferred to healthy eyes by unwashed fingers ; special basins, towels, sponges, washing flannels, and soap must be reserved strictly for the newborn child. The safest plan is to use rubber gloves in attending to infected eyes.

[1] The leaflet issued by the C.M.B. on this subject, printed in the Appendices to the Rules (p. 66), should be studied by the pupil.

Disturbances of the Digestive Tract.

Disturbances of the digestive tract are among the commonest troubles of young infants.

The mouth and tongue may be affected with small white patches (aphthæ), due to the growth of a fungus. This condition, known as **thrush,** arises from want of cleanliness in feeding, and, therefore, care of the mother's nipples or the teats and bottles is the way to avoid its occurrence. It is most likely to occur in weakly infants with digestive troubles, and this has given rise to the idea that the infection may pass through the intestine and cause an eruption on the buttocks. The child's mouth must also be kept clean, but great gentleness is required not to damage the delicate epithelium. A little glycerine and borax may be used to wipe the mouth, but medical advice ought to be obtained if the condition is associated with digestive disturbances. **Vomiting** occurs in all cases of derangement of the stomach and digestion, and is therefore nearly always due to bad feeding. There is a rare congenital malformation of the stomach in which the aperture from the stomach into the intestine is greatly narrowed (pyloric stenosis); in such cases the infant is constantly sick and will die in a short time, unless a simple operation is performed to save its life. Also in infectious and head injuries, vomiting may occur apart from digestive disturbance, but in the early weeks of life vomiting that is more than occasional is usually due to errors in feeding. It may be quite trifling, so that the child thrives and puts on weight in spite of it. In such cases there is probably only a little regurgitation of food immediately after feeding, due to the child having taken too much or too quickly or to its not being laid down quietly to sleep as soon as feeding is finished. Generally, vomiting from indigestion takes place some little time after meals, and the vomit is sour-smelling and contains curds.

With vomiting the infant generally also has **colic,** as shown by griping pains, during which it screams and draws its knees up on to the abdomen. The colic is caused by intestinal irritation, very often due to the passage of undigested curds, or to fermentation processes occurring in the intestine from bacterial invasion giving rise to gas-formation, "wind." **Diarrhœa** generally accompanies this, and is particularly frequent in summer-time when bacterial growth in milk is more abundant owing to the warmth. Curds are passed in the motions, which become green, frothy, and very irritating to the skin of the buttocks. This is due to the fermentation in the intestine, and the slimy mucus, which is often passed with the motions, is caused by catarrh of the intestines. Vomiting and diarrhœa are most serious in young infants, as a healthy baby may collapse in a few hours from a severe attack, and the large mortality of infants under a year is in great measure caused by these gastro-intestinal disturbances due to bad or unclean feeding. In serious cases of diarrhœa and vomiting the infant loses so much fluid that it becomes shrivelled, its skin loose and wrinkled and the interior fontanelle depressed below the surface of the skull. Medical advice ought to be obtained at once for these babies. Warm flannels to the abdomen may relieve severe colicky pains for the moment, but treatment depends on discovering the proper diet for the child.

Constipation, with the passage of hard and almost formed motions, is frequently the result of too small a percentage of fat in the milk, and is most often met with in bottle-fed babies, though it is also seen in breast-fed babies when the mother suffers from constipation, or if her milk is poor. The correct treatment for such cases is some modification in the food by which the percentage of fat is increased; cod-liver oil emulsion or olive oil is often useful. It is not good practice to give young babies aperient medicines, though an occasional dose of castor oil (one teaspoonful) or liquid paraffin (20 drops three times a day) may be given. Therefore in habitual constipation in the infant, a doctor should be consulted.

Sore buttocks are generally due to want of cleanliness or neglect in changing soiled diapers, especially when diarrhœa with the passage of irritating motions is present. They may also be brought about by the use of irritating soaps, or by the use of diapers containing washing soda, and by not drying the buttocks properly. The skin of the buttocks becomes red and angry, and sometimes raw, so that it

cracks and exudes fluid and bleeds. The child is very fretful and constantly cries from the pain. The condition is a serious one and must not be neglected.

First of all, great care must be taken to avoid soreness of the buttocks by strict attention to cleanliness. After washing the buttocks they should be dried carefully by dabbing, and vaseline rubbed into the skin to prevent the discharges irritating it. No soda should be used in washing diapers or towels for the infant, and a superfatted soap should be employed. Soon after feeding, when the bowels are likely to act, the diapers should be examined and changed if soiled, and in all cases frequent changing is essential. Should the buttocks become red, they are best cleansed with warm olive oil on a piece of lint, and dried with another piece of fresh dry lint. Afterwards, zinc ointment or lanoline should be smeared over them, and in severe cases pieces of lint with ointment should be placed on the buttocks. For any bad or obstinate case medical advice should be obtained, and always when diarrhœa or green motions are present. Sometimes congenital syphilis is the cause of redness of the buttocks (pp. 298 and 329).

Jaundice of a slight degree is not uncommon in newly born infants, and is not a serious condition requiring treatment; it generally disappears in a few days. It is usually most marked in small, feeble, and premature infants, whose resistance is low, and in the bottle-fed. It is supposed to be due to a slight catarrh of the bile ducts that follows the invasion of the intestinal tract by the usual bacterial flora.

Severe or malignant jaundice is a very rare condition, occurring in cases of infection of the umbilicus and in syphilis; it is nearly always fatal, and medical advice must be sought at once. The intense yellowing of the skin and whites of the eyes, the very dark urine, the high fever and extreme illness of the child will serve to distinguish this variety from the less serious types.

Various Infantile Diseases.

Retention of urine may be present from congenital occlusion of the urethra or from a tight foreskin (phimosis) in male children. In any case in which urine is not passed, a doctor's advice must be obtained at once; the case of a tight foreskin has already been mentioned (p. 293). A hot bath will sometimes help the child to pass water.

The urine passed sometimes deposits red brick-dusk powder on the diaper; this does not mean anything serious and need not cause alarm. In cases of severe jaundice the urine is very high coloured and stains the napkins.

Sometimes **complications at the navel** occur, especially at the time of separation of the cord. Hæmorrhage may occur from the cord itself within a few hours of birth owing to slipping of the ligature, and hence the midwife should satisfy herself that the cord is securely ligatured and religature it if there is any bleeding or if the ligature does not seem tight enough. From the fourth to the ninth day, with the separation of the cord, hæmorrhage may occur from infection interfering with healing, or from the stump of the cord being dragged away before healing is complete. Should anything more than a streak of blood be seen, medical help must be obtained. If the bleeding is severe—and the midwife must not forget that a trifling loss of blood may be very serious to a newly born infant—the navel can be pinched between the finger and thumb and compressed till help is obtained. If it will be long before assistance arrives, a darning needle should be boiled and passed through the skin under the navel and some boiled thread twisted over the protruding ends in figure-of-eight-wise. Simple pressure with a pad will not suffice in cases where the bleeding is enough to endanger the child's life.

Septic infection of the umbilicus may occur through want of attention to the cord and may give rise to fatal blood-poisoning. The stump of the cord becomes soft and moist and sometimes offensive, and there is a dirty discharge from the navel. Besides the danger of hæmorrhage there is a risk of the infection passing internally along the umbilical vessels to the liver—in which case a malignant form of jaundice will result. The infant will have high fever and perhaps hæmorrhagic spots or blebs like blisters (pemphigus) on the skin over the body, and will probably die in a few days. There may also be local inflammation of the skin of the abdomen

round the navel ; it may become red and hard and brawny with a raised edge. These cases are so serious that their treatment must be carried out by a medical practitioner ; " inflammation about, or hæmorrhage from, the navel " is the instruction given by the C.M.B. Rules (E 21 (5)) for the obtaining of medical advice.

A rare form of umbilical infection is that caused by the tetanus bacillus which causes lockjaw. It is almost unknown in this country, but may be met with by midwives practising in foreign missions or in the colonial nursing service, especially among negro races. Certain African races, for instance, dress the cord with dried earth, and this often contains tetanus bacilli.

Sometimes **swelling of the infant's breasts** occurs shortly after birth. This is only mentioned to warn the midwife not to interfere with it. It subsides in a few days if left alone, but ignorant and untrained women sometimes massage and rub the breasts to " disperse the inflammation," and in this way may cause abscess formation.

FIG. 117.—CONGENITAL SYPHILIS.

(From a photograph of an infant born in the General Lying-in Hospital, York Road, S.E.)

Large blisters (bullous syphilide or syphilitic pemphigus) are seen, confined, as is often the case, to the buttocks, arms, and legs. The extensive peeling of the skin of the palms and soles is a characteristic feature of this type of eruption. Though this condition was present soon after birth, attention may be directed to the fact that ". . . nothing is less common than for an infant to be born alive with extant signs of taint. Three weeks or a month almost invariably intervene before the eruption, snuffles, etc., appear. A very perplexing exception to this occurs in the case of what is known as infantile pemphigus." (*Syphilis*, p. 79, by Jonathan Hutchinson. Cassell & Co. Ltd.)

Various skin eruptions may affect the young infant. The most common consists of small red spots which contain a tiny vesicle of fluid, clear at first but later yellow, and are due to inflammation or blocking of the sweat ducts. Various types of these sweat rashes are seen, the ordinary " red gum " rash is one of them. If the spots are noticed to be particularly obvious on the child's back or over the abdomen where the flannel binder covers it, or where the child is likely to be particularly warm, probably some lessening of the amount of clothing and dusting with zinc oxide and starch will be all that is necessary. Redness and irritability of the skin in the groins, armpits, and in the folds of the neck and elsewhere, where the skin surfaces come together, may occur from want of care in drying and dusting the skin, and in such cases must be treated by special attention. Most of the minor skin troubles arise from like causes. The birth-marks and nævi ought to be mentioned also, as they can often be cured by special treatment while the infant is quite young.

The **serious skin eruptions** are mostly due either to inherited syphilis or to infection, and all require medical help (C.M.B. Rules, E 21 (5)).

Congenital syphilis does not as a rule show itself till the child is three or four weeks old, but occasionally appears soon after birth, and in rare cases the infant

may be born with signs of it. The first indication is usually "snuffles," which begins like a cold in the head, the passages in the nose being blocked by a swelling of the mucous membrane. The child is constantly snuffling and running at the eyes and nose. The skin about the angles of the mouth and round the anus becomes cracked and fissured and a scaly, reddish, "raw ham" or "coppery" rash appears all over the body. The colour is due to slight hæmorrhage under the skin which gives a faint staining to the skin, so that when it is pressed by the finger the colour does not disappear as it would from redness due to congestion of vessels. This coppery rash is often very marked about the buttocks and armpits, and there may be raised flat patches there (condylomata). Thick scaly patches on the palms of the hands and soles of the feet may also occur.

The child wastes and becomes withered up, so that it has an "old man" appearance, and jaundice may be present. An eruption of clear blebs like blisters (pemphigus) may also appear in serious cases. Naturally the midwife would get medical advice as soon as she had any reason to suspect a condition of this kind, but she ought also to be warned to be extremely careful not to acquire the infection herself, as the disease is extremely contagious (see also p. 329).

Suppurating sores (**impetigo**) may result from infection of the skin, especially where there are other children in the house with sore heads and the like, but the most serious skin eruption is **pemphigus,** though happily a very rare one. However, pemphigus in the new born is very contagious and is very often carried by the midwife, so that epidemics may follow the practice of one woman. It is probably due to an infection through the umbilicus, though its exact origin is not clear at present. Some epidemics are thought to have arisen from the nurse or midwife carrying streptococci in the throat and thus causing a "spray" or "droplet" infection of the infant during washing, etc. Blister-like blebs form on isolated spots of the body and suppurate or break into raw places, and the child rapidly becomes very ill and usually dies. In such cases the midwife should at once get advice and should not attend to other infants in case she should be the means of spreading the disease. This disease is singled out for special mention in the C.M.B. Rules—in regard to the child (E 21 (5)), where it is laid down that medical advice must be obtained for "serious skin eruptions, especially those marked by the formation of watery blisters." It will be seen that there are two forms of pemphigus, the syphilitic and the epidemic or septic; the latter is much the more serious of the two, and the one which is liable to run in epidemics. (See leaflet, p. 77, C.M.B.) The midwife must notify the case to the L.S.A. and, in accordance with Rule E 6, undergo disinfection.

Convulsions readily occur in infants as the result of irritation of the stomach and intestines from improper feeding, at commencement of serious illness, with high fever, and as the result of injury to the head. Medical assistance must be obtained as soon as possible and meantime the child should be placed in a hot bath, temperature 105° F., till the attack is over. Convulsions within a few days of birth are likely to be due to brain injury (p. 291).

Attacks of blueness (**cyanosis**) are liable to occur in premature and weakly babies, especially if there has been some difficulty in getting them to breathe at birth. In children who have been restored by prolonged artificial respiration, the lungs are often incompletely expanded (atelectasis), and heart failure is liable to occur. This generally shows itself by rapid respiration and cyanosis and is a very serious omen. While waiting for the doctor the midwife should put the child in a hot bath and give a few drops of brandy in warm water. If respiration fails, artificial respiration should be carried out as at birth.

In a book intended for midwives it is not possible to continue the hygiene and care of the infant beyond the first two weeks of its life. Those who undertake infant welfare as well as midwifery must have a separate book on the management of the infant. *Feeding and Care of Baby*, by Sir F. Truby King, issued by the Society for the Health of Women and Children, and published at 1s. 6d. by Macmillan & Co., may be recommended as suitable. Its teaching is common sense and practical and very decided and dogmatic, so as to impress its ideas on the public. Unfortunately there is a total absence of any systematic arrangement of subjects, so that till it is studied from cover to cover it is difficult to know where to find anything that may be looked for.

Another is *The Mothercraft Manual*, by Mabel Liddiard. Price 3s. 6d.

PART VII.—HYGIENE, MIDWIVES' DUTIES, ETC.

CHAPTER XXVIII.

THE PRINCIPLES OF HYGIENE.

Among the subjects of examination the C.M.B. includes "Elementary physiology and the principles of hygiene and sanitation as regards home, food, and person" (C 5 (*a*)). In the Introduction to this book sufficient elementary physiology will be found to fulfil the first part of this regulation. The latter part involves little more than the practical application of the subject-matter of the Introduction.

The conditions of the home, food, and person must, so far as can be, be those in which the growth and spread of bacterial life are minimized (p. 25) and those in which the resistance of the person is increased so as to render her best able to overcome invasion by infection (pp. 26–27). The first important essential for both these conditions is a free supply of pure air. Indoors, the air becomes vitiated by the want of ventilation, *i.e.* by the absence of free movement and fresh supply of air. The stale, stuffy feeling of an unaired room is easily recognized and causes headache and a heavy dull feeling in those who have to endure it. If the room is small and occupied by several persons, and still more, if gas lights, lamps, or candles are burning in it, the air becomes vitiated by the diminution in the proper amount of oxygen and the increase in the amount of carbonic acid. It is known to all that if the entrance of air from outside was entirely cut off, the oxygen would in time become entirely exhausted and the individuals present would die from want of oxygen. Again, the air coming into a room does not come entirely fresh from the outside; it comes in from the stairway and other rooms, and may be contaminated by decomposing refuse, dirty sinks and water-closets, or leaking drains, and thus allow harmful gases to enter the room.

Thus in a room a plentiful supply of fresh air, *i.e.* good ventilation, is essential, and the smaller the room and the more people in it and the more lights burning the greater the need of a constant change of air. So that the first practical point for the midwife is that a large airy room is better for the lying-in patient than a small one. But the midwife rarely has a choice of rooms, so she must next think of the means by which the room can be ventilated. The fire is a very important item in ventilating a room. The heat of the fire causes a strong current of air up the chimney, and fresh air must come into the room by doors and windows to take the place of the warm air driven up the chimney. When possible, without making the room too hot, there should be a fire, even if a very small one, in the grate, and in any case the flue should always be open. Oil stoves, unless placed in the grate, will not take the place of ventilation by a fire.

The next point to see is that the air coming in should be pure, and therefore it is better to get the air from outside the house by the window rather than from inside the house through the door. The midwife will often meet with difficulties and objections from her patients when she endeavours to obtain a plentiful supply of fresh air. The outside air may be purer, but it is also colder than that inside, and many patients prefer the warmth to the purity. Especially will this be the case in a small room in which the air has to be changed so frequently as to cause a feeling of draught, and, unfortunately, those who live in small stuffy rooms are specially susceptible to draughts. If, however, the top of the window is opened so that the inlet of air is high up, the cold air will come in and sink gradually down to the floor of the room (because cold air is heavier than warm air) and then be

drawn from the floor over the fire and up the chimney, thus producing a constant change of air but not so as to cause a decided draught. The amount the window is opened can be regulated so as to prevent too rapid a change of air and so too much cooling of the room. Besides this constant ventilation the air of the lying-in room should be thoroughly changed two or three times a day by opening the windows wide, the patient being meantime covered up to avoid chill.

In addition to seeing to a plentiful supply of fresh air from outside, the midwife must, so far as she can, see that impure air does not come into the lying-in room from other parts of the house or elsewhere. Defective drains and cesspools, allowing bad gases to enter the house, are a frequent source of ill-health. Sewer gases and evil-smelling air from drains and gullies are not in themselves a cause of puerperal infection—living organisms are necessary for that—but they give rise to sore throat, anæmia, and general ill-health, and thus greatly lower the power of resisting infection. For this reason the midwife should take the opportunity of visiting the house before the confinement (C.M.B. Rules, E 1), to inspect it and its surroundings, and, using her eyes and nose, note any dirty or offensive refuse, ash-pits, open gullies, or cesspools about the house, and the state of the water-closets and sinks in the house, especially if near the lying-in room. Should she notice any offensive smell and inefficient flushing, the matter should be reported to the local sanitary authority, and she should see that all collections of refuse are removed, and that the house and room are kept as clean and fresh as circumstances will permit.

Reference has already been made to the hygiene of the patient (p. 76) and of the lying-in room (p. 142). In regard to the latter, the ideal room is one in which the conditions are such as to be unfavourable to bacterial growth—sunny, airy, and dry—and free from dirty furniture and hangings, and in which the conditions are healthful to the patient, so that her powers of recovery and resistance to infection are greatest. An understanding of physiology and pathology as sketched in the Introduction is the best help the midwife can have for a practical application of the principles of hygiene to home, food and person.

CHAPTER XXIX.

DRUGS AND HOT PACKS.

The C.M.B. lays down no rules as to what drugs may or may not be used by the midwife. All that is ordered is that the midwife must note in her Register of Cases each occasion on which she is under the necessity of administering any drug other than a simple aperient, the dose, and the time and cause of its administration (E 19). This is intended to include *all* drugs used whatever way administered (*e.g.* by rectum, hypodermically, drops into eye, etc.), even when only used as a prophylactic (*e.g.* ergot). One of the stated subjects of examination (C 5 (*q*)), is—"The use of such drugs and solutions as may be required in practice; the conditions which call for their use, the mode of their administration or application, and their dangers."

The midwife should carry with her only the essential drugs and should only use them when there are very decided indications that they are required. Drugs play a very minor part in the treatment of midwifery cases, and the midwife should be careful not to encourage the ignorant and vulgar habit of medicine-taking. It is, however, necessary that she should have some idea of the uses of such drugs as may be required.

Aperients are the most important, and of these *castor oil* is the most generally useful. It is especially to be recommended just before labour and for the first aperient afterwards, on the second or third day. It is not suited for habitual use. Unless the patient reacts very readily to aperient medicine, a full ounce is required for a woman in bed and on a simple diet. Half that may suffice in some cases, but there is always a danger that too small a dose will not act properly and result in frequent small and ineffective actions. Pure castor oil is almost tasteless, but its oily character makes it repulsive to some patients. If it is at all rancid it may give rise to gastro-intestinal irritation and vomiting. It is best given in hot milk or strong coffee or with lemon syrup. A little hot milk is poured in a wineglass or small tumbler so that the bottom and sides of the glass are moistened with the milk; the dose of oil is then slowly poured down the sides of the glass so that it forms a layer or ball on the top; more milk is then poured carefully on to the top of the oil, which is then suspended between two layers of milk. If swallowed in a big gulp the layer of oil may not be broken and so escape notice by the patient. For the baby, the dose is from 15 to 60 minims. (See warning, p. 295.)

Medicinal paraffin or some preparation of it is very useful for habitual use—it never enters the tissues of the body, being passed through the digestive tract without absorption. It also prevents the fæcal matter retained in the large bowel from binding into hard masses. The dosage requires to be regulated by the patient to her own requirements and it is often useful to combine it with another aperient (such as an aloes pill) at first. A dessertspoonful at night or a teaspoonful after each meal is an average dose to begin with.

Compound liquorice powder, 1 teaspoonful, or 2 in cases of sluggish intestinal action, or liquid extract of cascara, 1 to 2 teaspoonfuls, are useful for habitual use.

Calomel, extract of aloes, and *cascara*, are often made up in convenient pill form for use when an aperient is required for habitual use. Some preparation of the kind is usually kept as a stock pill in hospitals. When not otherwise available, some equivalent for the hospital "house-pill" may be obtained from a doctor with instructions as to the cases for which it is suitable.

Epsom salts (*magnesium sulphate*) are useful in cases where the abstraction of fluid from the body is indicated—when the breasts are full and the infant not being suckled, or when there is dropsy, especially with inefficient action of the kidneys.

A dessertspoonful to a tablespoonful dissolved in water and flavoured with lemon or peppermint may be given first thing in the morning, or three times a day till the effect is seen.

The **liquid extract of ergot** ought to be carried by every midwife. It is a very useful drug to stimulate uterine contraction and retraction. It is not a good drug to employ during labour, as it tends to produce long-drawn-out and permanent uterine contraction—the form of uterine activity most valuable in checking bleeding, but not of the kind to expedite delivery. Indeed this very property of checking the circulation is a danger to the child by cutting off the placental circulation. Ergot should not be given before expulsion of the placenta unless labour is complicated by hæmorrhage, and only then if it is clear that there is no obstruction to delivery. The Scottish rules (E 19) prohibit the use of ergot before the birth of the child.

A fresh preparation should be used, as ergot deteriorates rapidly with keeping, and a dose of a drachm or a drachm and a half can be given after the birth of the placenta. Half a drachm, three times a day for the first three or four days of the puerperium, is useful in promoting retraction and the expulsion of clots. It is a rational method of treating afterpains by the permanent contraction it tends to produce.

Ergotin in pills or tablets of 3 grains may be used in place of the liquid extract and has the advantage of keeping its active properties longer. Ergotin may also be administered by intramuscular injection into the buttock when rapid action is required.

Pituitary extract (of which such trade names as "Infundin" and "Pituitarin" are in common use) is obtained from a gland at the base of the brain (p. 22). It has the effect of increasing the activity of the involuntary muscular fibres throughout the body, such as the uterine muscle, intestinal muscle (hence sometimes used to promote evacuation of the bowels), and the muscle of the arterial walls and heart (hence the blood pressure is raised, so that it is used in shock). It is a better drug for use in labour than ergot, as it increases the strength and frequency of the pains instead of producing the prolonged contraction which ergot tends to bring about. It should not be given when there is any obstruction to labour, and is best reserved for cases of uterine inertia with the head low down in the cavity or detained at the outlet. The effect of the drug is generally rapid, five to twenty minutes, and if it has not produced delivery, the forceps ought to be applied in case the uterine contraction interferes with the placental circulation and causes death of the fœtus. It is also valuable after the birth of the child in preventing and checking postpartum bleeding. It is occasionally used earlier in labour in antepartum hæmorrhage under similar conditions to those governing the use of ergot. Its effects are variable and somewhat uncertain; occasionally it provokes violent uterine action, and may cause rupture of the uterus. The strength of the preparation is now reckoned in physiological units, usually in 1 c.cm. there are 10 units (sometimes 5). The dosage is 2 units before the birth of the child, but the full 10 units may be given after birth for postpartum hæmorrhage: ½ c.c. of infundin or pituitarin is injected intramuscularly deep into the buttock, or it may be administered intravenously or per rectum in normal saline. From what has been said as to the circumstances in which it is administered it will be evident that it is not a drug the midwife would use until after the child is born. It is as well, however, that she should have some knowledge of its action and method of administration, and those midwives working where medical help may be long delayed should carry it for use as an emergency measure in postpartum hæmorrhage (in Scotland, prohibited before birth of child).

Aromatic spirits of ammonia (**sal-volatile**) is useful as a rapid stimulant in cases of faintness and collapse. A half to 1 drachm with a little water is the usual dose.

Sedatives.—The use of sedatives in labour is questioned by some authorities and unfortunately there is a lack of uniformity among teachers and administrative officers of the L.S.A. Local Health Committees are apt to think that, as some of these drugs are scheduled in an Act of Parliament, the Dangerous Drugs Act, they have thereby become dangerous, not realizing that the Act refers to drugs of addiction, *i.e.* those that may give rise to a drug-habit but not dangerous from their occa-

sional administration. Strong spirituous liquors might as well have been scheduled in the Act because of the alcoholic habit. Laudanum was in every family medicine chest a generation ago, and is no more " dangerous " now than then.

To the writer the prohibition of the use of such drugs by the midwife appears to be wholly unreasonable, and to show a lack of appreciation of the principles of preventive medicine as applied to midwifery practice, besides being a needless deprivation of a safe and simple means of easing the pains of labour to many women who urgently require it. Probably this opinion arises from his having seen the benefit of their use by the well-trained midwives of the old school (before the days of the Midwives' Act) and recognized how many cases of instrumental interference were avoided thereby. The midwife is not prohibited (see below) from using them, and should be instructed in their use. If she has been, as she ought to have been, so instructed, she should be able to recognize the occasions in which they would ease her patient and prevent many instrumental deliveries.

Elsewhere it has been stated in this book that fatigue is one of the commonest causes of weakness of uterine action, and, further, that rest and relief should be obtained, when the patient is *tiring*, and before she is, in fact, *tired out*, that is to say, before there is any real abnormality requiring medical aid. Especially is this the case when the pains early in labour are erratic, severe, and irregular, so that the woman becomes early distressed, whilst dilatation is slow, and the os rigid. Again, in the first stage, if the patient begins to show signs of loss of control, restlessness, associated with a lessened frequency and strength of the pains, she requires rest and sleep. If the membranes are still unruptured, a sedative should be administered and rest obtained. Delay of some hours for the arrival of the doctor means that the favourable moment has passed, and probably instrumental interference will not be prevented. If the membranes have ruptured early, and the doctor is within easy reach, medical assistance should be sent for.

If delay occurs, when the head is low down and near the outlet, it is again too late for rest and sleep to be effective, the time has passed when the prevention of weak uterine action is likely to succeed, and, therefore, delay at this stage is usually best treated by the forceps.

Other instances in which these drugs are required will be found here and there throughout the text; here indications will chiefly be given as to the use of particular preparations.

Chloral hydrate is valuable as a sedative—to induce sleep, dull the pains, and relax rigidity of the soft parts, and is especially of use in cases of uterine inertia with rigidity of the os.

The usual dose is about 20 grains, but most commonly the syrup is carried, and that contains 10 grains in each drachm, so that the dose would be 1 or 2 drachms.

Potassium bromide is sometimes used for the same purpose as chloral—the dose being 20 to 30 grains. A common sedative mixture for use in maternity districts is a mixture containing 20 grains of chloral and 30 grains of potassium bromide to 1 ounce of water—½ to 1 ounce being given according to the needs of the case.

Opium is, however, the best all-round sedative for midwifery work and one of the safest.

The preparation of opium in most general use is the tincture, " laudanum " as it is commonly termed. It contains 1 grain of opium in about 15 minims and the dose is from 10 to 20 minims—15 being an average dose. Sometimes opium is carried in the form of a pill—containing 1 grain of opium—the dose of this being equivalent to 15 minims of laudanum. The pill has the advantage of allowing of no error of dosage and requiring no measure glass, but is liable to become hard and not readily absorbed into the body; it is also slower in action. Another preparation is Dover's powder (compound ipecacuana powder) which contains one grain of opium in 10 grains. It can be carried in tablets of 5 grains, one or two being given as a dose. If one only is given, it is a good plan to give also two five-grain tablets of aspirin. Morphine is the active principle of opium and is used in hypodermic injection (⅛ to ½ grain) when rapid action is required. The midwife in this country is not allowed to carry morphine.

Opium is valuable in easing the pains to allow of sleep, so that though it

diminishes the uterine contractions for the time being, it brings on increased activity after the period of rest. It is also very valuable in diminishing rigidity and thus aiding dilatation. In hæmorrhage it is again useful in the peace of body and mind which it brings to the patient, and the absolute rest of a quiet sleep gives the best chance for the natural cessation of bleeding ; especially is this the case in threatened abortion. In prolonged labour, with excessive retraction, it will give rest to the uterus and so to the patient also, and will postpone the onset of tonic contraction and the exhaustion that accompanies it. It ought always to be carried by the midwife, unless she is working directly under some institution or under such conditions that medical help or drugs are available at short notice. By the regulations issued under the Dangerous Drugs Act, 1920, certified midwives, who have *notified their intention to practise*, are authorized, under appropriate conditions, to purchase and be in possession of medicinal opium for use in the practice of midwifery. Midwives practising in Scotland are not trusted in this way, see p. 323.

THE HOT WET PACK.

The hot wet pack may be ordered in convulsions, delirium, or chorea as a sedative, in uræmia, suppression of urine, or in inadequacy of the kidneys to promote the secretion of urine and free action of the skin. Eclampsia is perhaps the most likely condition for which the midwife might be called on to administer a hot wet pack.

It may be looked on as the application of a fomentation to the whole body, and requires great care to avoid scalding the patient and chilling afterwards.

The method of administration is briefly as follows :

A mackintosh between two blankets is rolled beneath the patient, and she is stripped beneath another blanket and a hot-water bottle put to her feet. For the hot pack two thin blankets, two large bath-towels, or two draw-sheets may be used according to which is most readily available. Blankets keep the heat longest, but are more difficult to wring out properly ; large bath-sheets are very good but not often at hand, and hence draw-sheets will probably be most often used. One is folded double in the width and rolled up loosely, the other grouped up from end to end in puckers for ease of manipulation, and both wrung out of boiling water or a kettleful poured over so as to saturate them. When the water has been wrung out of them, they are given a quick shake to free them from steam, which might burn, and the doubled one rolled under, and the other laid over, the patient being tucked in round the shoulders, pressed into the armpits and around and between the limbs. All this should be done rapidly, with the least possible exposure, under the blanket, and the patient then covered with a mackintosh and two or three more blankets, all of them being tucked closely below the under blanket. Hot bottles, preferably of rubber so that they can be placed below the knees and in the armpits, are then packed round the patient next to the dry blankets, not the damp sheets, in order to maintain the heat. A cold wet cloth to the head may prevent headache or throbbing ; if the patient is conscious, copious hot drinks of barley water or lemon should be given, and the pulse carefully watched, which is most easily done by taking it at the temple. If the skin acts well, the pack can be continued for half an hour. The blankets are loosened, the damp clothing rolled carefully out from above and below the patient, who is then left between the hot dry blankets till the skin has finished acting, perhaps another half-hour. She is then rubbed down with hot towels or given a rapid warm sponge under the covering blankets, great care being taken to avoid exposure and chilling, or she may be allowed to cool down gradually by the removal of a blanket from time to time. A warm flannel night-gown is put on, the patient left between blankets, and if conscious given a warm feed. Should she be delirious or difficult to control, one blanket or sheet only is used, the sides being rolled up in the middle before it is wrung out ; to facilitate the rapid envelopment of a struggling patient, she can be held over to one side and quickly rolled into the hot sheet.

CHAPTER XXX.

OBSTETRIC OPERATIONS AND THE MIDWIFE'S DUTIES IN REGARD TO THEM.

Although the midwife is never called on to perform these operations, she ought to know many things regarding them if she is to take an intelligent interest in her work, and if she is to act as a skilled assistant to the medical practitioner. She ought to have some idea of the occasions on which these operations are needed, as this will help her to decide when to obtain assistance, and she ought to know the instruments used, how to prepare them and the patient for operation, and what to do during the operation as so to enable her to be of service to the doctor. In this chapter, therefore, the operations will be described, and the instruments in common use : the conditions which call for them will be noted, and the midwife's duties will be explained, regarding—(1) arrangements and preparation of the patient ; (2) assisting the doctor during the operation ; (3) the after-treatment of the mother and child.

Forceps Delivery.

Forceps delivery is the commonest operation in obstetric work, and may therefore be described first.

The **midwifery forceps** is aptly compared to a pair of artificial hands, which are applied to the child's head to pull it through the pelvis, when the natural forces acting from above are not strong enough to expel it by themselves. The type of forceps in use varies considerably, and if the midwife works with different medical men, she will also see nearly as many varieties of forceps. Essentially they are all the same, so the two common types in general use will be taken for purposes of description.

The ordinary instrument is made of steel, nickel-plated to prevent rusting, and consists of two halves, commonly called the blades, which are introduced separately and afterwards locked. Each blade is made up of—(1) the blade proper, or part which grasps the head ; (2) the shank ; (3) the lock ; and (4) the handle. The blade where it grasps the child's head is curved like a spoon to fit the head, and is made smooth and without sharp edges to injure mother or child. It has a considerable amount of spring and is fenestrated for the sake of lightness and to avoid injurious pressure. The shank is a short and more rigid part between the blade and the lock, which gives length to the forceps and allows the locking to be done outside the vulva and so obviates the risk of including some of the mother's tissues in the lock. In the modern instruments the handles are also made of metal, so that the instrument can be boiled, but in the older patterns they were of wood.

Besides the curve for the child's head, the forceps has another curve—the pelvic curve—the necessity for which will easily be understood by those who followed the description of the pelvic axis in Chapter I. (p. 37). The forceps has a curve corresponding to the axis of the pelvic canal, so as to be more easily applied, and, when applied, to lie comfortably in the pelvis. If the blades are brought together and locked, it is quite easy to see this curve, and to notice that it corresponds to the curve of the sacral hollow, thus indicating the way in which the blades lie in the body. They will lie with the tip in front towards the pubes, their curve fitting the sacral hollow, and the shanks and lock lying just outside the perineum. The left blade is applied first, so that in the usual position of the patient on the left side, it is also the lower blade. The midwife ought to be able to tell the left or lower blade, and, if required, hand it to the doctor first. When the blades are together, this is

very easy, as she has only to look at her patient and notice how the curve lies, to see which way they must be in the body; then the lower of the two blades is the one to be used first. To tell when they are separate is also easy if the direction of the pelvic curve is kept in mind. Take a blade in the hand, with the hollow of the spoon looking upwards, *i.e.* in the position it would have to be to receive the lower half of the head; imagine it being passed into the patient's pelvis, if it is the lower blade, the curve will be seen to fit the pelvis so that the point will pass up and forwards towards the pubes, while if it is the upper blade, it will be evident that the point would pass backwards into the hollow of the sacrum. A few minutes' study of the instrument and a little explanation from the doctor, the first time she has a case of forceps delivery, will make all this quite plain to the midwife. After the left lower blade has been put on, the right upper one is applied, the handles locked, and the extraction commenced.

Another type of forceps is the **axis-traction forceps.** It can be easily recognized by its having two curved rods attached to the lower part of the blade, just below where the head is grasped, and a cross-bar handle fitting on to the other end of these rods. In this type of forceps the ordinary handles are only used for applying the instrument, all pulling being done through the cross-bar handles and traction rods.

The advantages of this forceps may be briefly explained as follows. It is possible to pull in the axis of the brim, which cannot be done with ordinary forceps; the axis of the inlet has been stated to be very nearly that of a line drawn from the umbilicus to the middle of the coccyx (Fig. 21), so that it is quite evident that, however far back the shank is pressed, it cannot be got as far as the middle of the coccyx, so that the direction of pull can only be in a line from the umbilicus to the front of the perineum, instead of to the middle of the coccyx, which is behind the anus.

The traction rods get over this difficulty; they pass down behind the shanks of the forceps, and take a curve round behind the perineum and anus, so that when the pull is made it is exactly in the axis of the inlet, and therefore much more efficient. This advantage not only applies to cases where the head is detained above the brim; there is a further benefit when the head is in the cavity, *i.e.* that it is much easier to pull in the correct axis because the application handles follow the movements of the head, and by keeping the traction rods parallel to them the doctor knows that he is pulling in the right direction; with the ordinary forceps it is difficult to be sure of this. The objections to it are—(1) It is more complicated, and has more joints and crevices in which dirt may collect; (2) it is somewhat more cumbersome to carry about and to apply. As in most cases in which the forceps is used the head is low down, when the ordinary forceps is nearly as good, many practitioners prefer to keep the axis-traction forceps for the "high" operation or "head above the brim" cases. There are, however, several patterns of axis-traction forceps, such as Neville's, where the traction rods are arranged to fit on near the shank and so are much less cumbersome.

Let us now endeavour to give a short sketch of the conditions calling for forceps delivery, so that the midwife may obtain early assistance if she recognizes that the occasion for it has arisen.

The chief use of the forceps is to supplement the natural forces of expulsion, when they are insufficient to bring about the delivery of the child, or only able to do so after prolonged and unnecessary suffering on the part of the mother. This insufficiency in the natural forces may be due simply to their being feeble, or it may be that there is also some obstruction to the passage of the head, as from too small a pelvis or too large a head, and that the labour pains are not strong enough to overcome this. Besides these occasions, forceps may be necessary to expedite delivery when there is some danger to mother or child.

The indication for the use of forceps may be classified as follows:

1. In Delayed Labours—

(*a*) *Faults in the Powers.*—Uterine inertia, weakness of the accessory muscles.

(*b*) *Faults in the Passages.*—Bony or soft, *i.e.* contracted pelvis, rigid perineum, etc.

(*c*) *Faults in the Passenger.*—Large or firmly ossified head, occipito-posterior positions, extended aftercoming head, etc.

2. In Dangerous Labours—

(*a*) *Maternal complications, e.g.* eclampsia, hæmorrhage, heart disease, etc.

(*b*) *Fœtal complications, e.g.* prolapse of cord, asphyxia, etc.

There are four conditions, which must be present before the forceps can be applied. They are—(1) The membranes must be ruptured; (2) the os must be fully dilated; (3) the head must be presenting; (4) the patient must be having pains, *i.e.* the uterus must not be in a state of complete exhaustion.

These conditions narrow the occasions for the forceps. The forceps is only applied to the head, and only after the first stage of labour is complete, and only when the patient is having pains of some kind, however feeble.

The forceps is not used as a dilating agent, and so long as the bag of membranes is entire, neither mother nor child will come to any harm, besides which the bag forms the best possible dilating agent. If there is delay when the os is fully or almost fully dilated, the membranes ought to be ruptured, because this will stimulate the uterus to further activity, and allow the head to come into the os to complete the dilatation. If the membranes have ruptured early, before the os is fully dilated, and the head can come into the os and continue the dilatation, then the forceps is not required till this is complete. In a few rare cases, then, where the head is detained above the brim, the forceps is sometimes applied before the os is quite fully dilated, but only to bring the head into the os and not to drag it through and so run the risk of severely lacerating the cervix. Also very rarely in cases of dangerous complications like eclampsia, it may be considered that the danger of delay is greater than that from laceration of the cervix, and the forceps may be used because of the grave state of the patient. In such cases time is taken to work the incompletely dilated cervix over the head.

For the dangerous complications, the midwife would have already sent for the doctor, and we need not consider them further. Also in those cases where the head is detained above the brim, the condition ought to be recognized, whether due to contracted pelvis, tumours, or large head, etc., and advice on that account obtained. By far the most frequent cause for the application of forceps is delay in the second stage of labour, either from uterine inertia, persistent occipito-posterior position, or large size of the fœtal head. These conditions have already been considered in other chapters (XIII. and XVIII.).

Preparations.—First let us take the instruments. The doctor may bring a sterilizer, but if not, and a large fish-kettle can be got which will hold the forceps, so much the better; it ought to be well cleaned out, filled with hot water, and put on to boil. If this is not available, a large kettle which will take the forceps up to the handles will be of use, but if it also is not obtainable, the instruments must simply be placed in an antiseptic solution In any case, a receptacle, containing lotion, will be required for them before use. For this purpose nothing is better than a toilet jug or large milk jug, in which the instruments can be placed, with the blades downwards and the handles upwards. It ought to be cleaned, filled with cool boiled water or an antiseptic solution (if the midwife knows what the doctor is in the habit of using and has the materials at hand), covered with a clean towel and placed on one side. As perineal lacerations are not uncommon after forceps delivery, means for suturing them ought to be got ready at the same time as the other things. The suture material is often taken ready sterilized from the bottles in which it is brought, but the nurse ought to be ready to sterilize it and the needles, dressing, forceps, etc., by boiling or treatment with antiseptic, as may be required. If boiled, the ligatures, needles, and other small things ought to be wrapped in a piece of gauze, to prevent their being lost and for ease of removal, or else a small pan ought to be provided specially for boiling them. A separate dish is for the same reason to be provided for ligatures and needles, as it is difficult to pick them out of a big basin containing many instruments, and for this purpose a soap dish does very well.

As a vaginal or intrauterine douche may be required afterwards, the necessary preparations ought to be made.

Next, as regards the arrangement of the room, bed, and the preparation of the patient, though much of this may have to be done later, after the arrival of the doctor, or even after the patient is under an anæsthetic, it will be best to describe the whole procedure at once.

As the patient is usually placed across the bed, with her buttocks on the edge, the part of the bed where she will lie ought to be carefully arranged, so as to be as convenient as circumstances permit. As mentioned in a previous chapter, it is most important that the bed does not slope down to the centre, as not only does the patient tend to slip down the incline, but blood and douche fluids also follow the same route and so may cause great mess in the bed. If the bed is of this kind, it must be remedied as far as can be, by the use of boards, packing with pillows, and so on. This part of the bed must be prepared with mackintoshes and draw-sheet in the usual way, a pail or foot-bath should be under the bed, and if there is a carpet, a piece of oil-cloth or matting ought to be placed underneath to prevent soiling. Newspapers are often useful when sufficient mackintosh sheeting is not available. The bed ought to be in that position in the room which will provide the best light for the doctor. In applying the forceps he will probably sit on a low chair facing the patient, and will require another chair or two or a small table for his basins of lotion and instruments.

Much of what follows with regard to the preparation of the patient may be best done when she is under chloroform, or the doctor may prefer to see to some parts of it himself, but the midwife ought to know what to do in case she is called on. If the directions in regard to the feeding of the woman during labour have been followed, many of the troubles consequent on the anæsthetic will be avoided ; also if the bowels have been well emptied, things will be much more comfortable for all concerned ; in any case it may be worth while to wash out the lower bowel with soap and water so as to avoid any risk of contamination from there. So also if the pubic hair has not been shaved or well trimmed, it ought certainly to be done now, for the sake of keeping the long hairs out of the lock of the forceps, as well as for the sake of cleanliness. The patient should be told to pass water, though everything must be got ready for passing the catheter, as many practitioners prefer to have this done or to do it themselves before every forceps operation.

As soon as the doctor has examined and satisfied himself as to the nature of the case, he will decide whether an anæsthetic is required and give instructions as to the preparations to be made. He will probably commence the administration of the chloroform—we will suppose it is a case requiring this—while the nurse gets the instruments and lotions ready. As soon as the patient is " under " she will be placed in the position for the operation ; she will be lifted across the bed so as to lie on her left side, with the buttocks at the edge of the bed, and indeed a little over it, and the knees drawn a little up on the thighs. The reason for having the patient so well over the bed is that the handle of the upper blade has to be depressed considerably in introducing it, and may come in contact with the bed if this is not done. The final cleansing of the vulva may be done by the doctor or entrusted to the nurse. In the event of no second practitioner being present to attend to the chloroform, the nurse may have to keep the patient under during delivery (for advice on this point see p. 315).

When all is ready, a pillow is placed between the knees, or the right knee is held up, this being especially necessary during the passage of the upper blade. At first, the best position for the assistant is sitting or standing behind the patient, unless it is necessary for her to remain at the other side of the bed to continue the anæsthetic ; when the lower blade has been passed she may have to hold it in position while the other is being passed, and if so she must keep it exactly as instructed, for if it slips out of position it may be difficult to lock the blades. Usually the handle of the first blade is held firmly back against the perineum. If it is a high forceps operation, and the head is above the brim, she may be asked to fix the head with her hands through the abdominal wall, while the blades are being applied ; if so, it must be done by pressing down with the two hands, as in the method for palpating the fœtal head (p. 127, and Fig. 64). When the forceps has been applied and traction begun, she must exercise counter-pressure on the buttocks. During the final stages

of extraction she may be required to put her hand on the uterus and follow it down and help by expressing.

She should be ready as soon as the child is born to see to the eyes and mouth, as in normal cases, or if the child is not breathing well to assist in establishing respiration. After the placenta has been born, she must be ready with the douche things if required or to assist in the suture of lacerations and to clean up the patient.

There is little special to be noted in the after-care of mother and child, as this does not vary from the ordinary cases. Anything abnormal in either patient should be at once reported and a careful watch be kept. The child may show bruising, or develop a cephalhæmatoma, or show paralysis of one side of the face from pressure on the nerve (p. 290, Figs. 114, 115, and 116).

If the dorsal position, as usually adopted on the Continent and in America, is chosen, instead of the left lateral as in this country, the patient lies on her back and is brought to the edge of the bed, so that the buttocks project a few inches when the legs are held up. During the operation the legs must be held by assistants

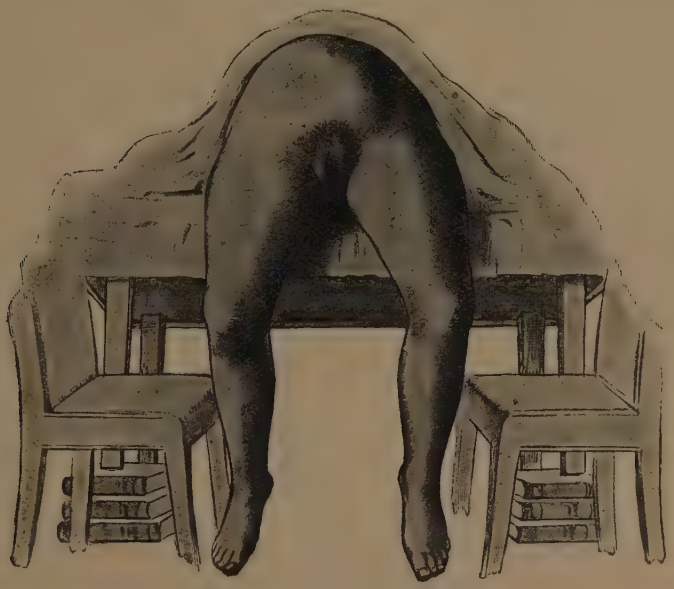

FIG. 118.—WALCHER'S POSITION.

The patient is lying across a table so that her feet do not touch the floor, and the table tilted so as to obviate the tendency to slip off. Between the pains the feet can be rested on the chairs.

(From Tweedy and Wrench's *Practical Obstetrics.*)

or supported by a roller towel or bandage as described on page 314. The doctor will require a stool or small chair, so that he is facing the patient.

In flattened pelvis with the head detained above the brim, the Walcher position (pp. 61 and 200) may be adopted till the head is down into the cavity of the pelvis. The patient must be placed on her back on a high bed or table with her legs and thighs hanging down so that the feet do not touch the floor. Unless they hang with their full weight on the pelvis the rotation forwards and downwards of the pubes will not occur. If the bed or table is not high enough, stools or blocks or some substitute for them must be placed under the legs on the side on which the patient hangs so as to tilt the bed or table and keep her feet from the floor. The patient's legs need only hang down during the pains, and the midwife must do all she can to mitigate the discomfort to the woman while in this position by providing chairs for her to rest her feet on between the pains, by keeping her legs warm with stockings and her body by blankets and hot bottles.

Craniotomy is a general term to indicate the mutilating operations performed on the fœtal head in order to diminish its size and so allow it to pass easily through the pelvis. These destructive operations are now rarely done on a living fœtus,

delivery by Cæsarean section being attended with so small a mortality that it is naturally preferred whenever possible. If the fœtus is dead, craniotomy is always done in difficult cases as it makes the delivery easier and less risky to the mother. Destruction of the living fœtus is done only when there is reason to suspect serious damage to fœtus (*e.g.* extensive fracture of the skull) that leaves little chance of its survival, infection of the mother, or when the condition of the mother or her surroundings makes Cæsarean section impossible. Hence the usual indication for craniotomy is some disproportion between the child and the maternal passages which renders easy delivery impossible, the fœtus being dead or seriously injured, or the conditions unsuitable for Cæsarean section.

The preparations for the operation are the same as for forceps delivery.

The operation is carried out by the doctor passing an instrument (perforator) up to the skull and boring a hole into the cranial cavity. Should the head be movable above the brim, the midwife must assist by fixing the head as firmly as she can by pressing it down with both hands towards the pelvis. After the skull has been perforated and the opening made wide enough, the brain is scooped out so that the skull will collapse, and then delivery is carried out by some method suitable to the case. If the pelvis is roomy, the head may be delivered by forceps ; if the head is still too large, it may be necessary to break it up still further by pulling away the bones forming the vertex (**cranioclasm**) or the head may be crushed (**cephalotripsy**). If the uterus is sufficiently lax and the pelvis not too small, version may be done and the child delivered as a breech, when the perforated aftercoming head will collapse and come through the brim quite easily.

These destructive operations are extremely messy, so the midwife should see that all preparations have been made to prevent more soiling in the room than need be. Should the parents wish to see the baby, the head should be made to look as natural as possible by filling the cranial cavity with tow or wool and stitching the scalp over it, and the child dressed so that the parents can see as little as possible of the damage done. To save the mother's feelings it is far better that she should not see the baby.

Version, or turning the child in the uterus so as to substitute one presentation for another, is done under a great variety of conditions. A common indication is a transverse lie. It is also done in brow presentations when conversion into a vertex or face is impossible, and sometimes in difficult face cases if the head is high up. It is one of the methods of treatment in antepartum hæmorrhage due to placenta prævia where the half breech is brought down and used as a plug during the stage of dilatation. It is good treatment in prolapse of the cord and when rapid delivery is necessary and the forceps not available. The operation may be done by external manipulation only—*external version*—or by combined internal and external manipulation ; of the latter there are two varieties, *bipolar version*, when the os will not admit the whole hand and two fingers only are used, and *internal version*, when the whole hand is passed into the uterus.

External version may be used to produce either a head or a breech presentation ; bipolar version is nearly always, and internal version always, podalic, *i.e.* used to produce a footling.

For **external version** to be possible there must be plenty of liquor amnii and a relaxed uterus so that the fœtus is freely movable and no part of the child must be engaged in the pelvis. Hence it is only possible before labour sets in or very early in the first stage. A strong abdominal wall makes it difficult, so that in a primipara an anæsthetic is generally necessary to cause full relaxation.

It is especially valuable in transverse lies, placenta prævia, and to change a breech presentation in a primipara into a vertex.

In performing the operation the patient lies on her back as for an abdominal examination and the fingers of each hand are placed on opposite poles of the fœtus, and by pushing the one pole up and the other down by a series of firm taps the child is rotated round its centre and its presentation changed. To take the best example—a transverse lie with the head, say, in the iliac fossa, the back to the front, and the breech on the right. In order to turn this into a vertex presentation, the fingers of the left hand would push the breech from the right up towards the fundus,

whilst with the right hand the head would be pushed from the left iliac fossa towards the pubes until it was over the brim. A firm and well-padded binder would then be applied to try and keep the head in position, as the malpresentation is likely to recur. On the other hand, if it was desired to bring about a breech presentation, the breech would be pushed down on the right side towards the right iliac fossa whilst the head was raised from the left iliac fossa upwards towards the left side and so to the fundus. This operation has been described in some detail because the midwife working long distances from medical aid—as in the colonial nursing service and in remote country districts—may have to attempt to rectify a transverse lie by such manipulation, as once the labour has advanced or the membranes ruptured, internal manipulation is necessary and naturally that increases the risk. That a manœuvre so simple and without risk will suffice in cases of transverse lie when seen early enough will impress on the midwife the necessity of early diagnosis and early assistance in such cases.

Bipolar version is carried out most commonly in transverse lies when too late for external version alone ; in placenta prævia, when it is required to bring down a foot and use the half breech to press on the placental site during dilatation.

The doctor passes the whole gloved hand into the vagina and two fingers through the os, so that the operation cannot be done until the os is dilated sufficiently to admit of this. Suppose the presentation is a first vertex and it is desired to produce a breech. The internal fingers push the head out of the brim and up towards the left iliac fossa. The external hand pushes the breech down from the fundus towards the right side. This brings the shoulder over the os and the internal fingers then push the shoulder up after the head to left. The external hand (or an assistant if available) pushes up the head from the left iliac fossa towards the fundus and pushes down the breech from the right side to the brim until the head goes up into the fundus. When the breech is over the brim the membranes are ruptured and a foot brought down if required.

In **internal version** the whole hand is introduced into the vagina and then, bringing the tips of the fingers together so as to make it cone-shaped, the whole hand is worked carefully through the os if dilatation is not quite complete. The presenting part is pushed up out of the brim and the hand passed closely along the child's body till a knee is reached. At the same time the external hand pushes down the breech so as to bring the leg more easily within reach. When the knee is felt the leg is gently extended until the ankle can be grasped between two fingers. Gentle traction is now made on the leg from inside, drawing it down towards the vagina while the external hand, helped when possible by an assistant, raises the head towards the fundus and pushes the breech down towards the pelvis. When the version is complete the foot is brought down to the vulva, and unless there is reason for haste, the rest of the labour is left to nature.

It is quite clear that, as the whole hand has to be passed up into the uterus, the risk of infection is greater than in other forms of version, but rubber gloves and strict cleanliness reduce this risk to a minimum. Another advantage of the rubber gloves is the greater ease with which the hand can be passed into the vagina when covered with smooth rubber, though they have a slight disadvantage in giving a somewhat more slippery hold of the foot. However, the traction required is slight, so that is no great objection.

The midwife in these operations must be prepared to render what assistance may be required in the way of pressing the head up or the breech down, and generally following the doctor's instructions in giving assistance in the abdominal manipulations. She must have everything ready for the restoration of the child, especially in cases where podalic version is done, because extended arms and delay with the aftercoming head are frequent.

Decapitation, *i.e.* cutting through the child's neck, is chiefly required in cases of neglected transverse lie. In cases where the shoulder is impacted in the pelvic brim and the uterus firmly retracted on the child (Fig. 90, p. 183), version is impossible, and indeed to attempt it would mean rupture of the uterus. Hence, in such cases the only thing for the doctor to do is to divide the head from the trunk so as to break up the wedge ; the head is then pushed up and the headless trunk

delivered by making traction on the prolapsed arm. The operation is carried out by means of a sharp hook passed up over the neck, or by a strong pair of scissors or a wire-saw. The operation is a difficult and dangerous one and may result in injury to the maternal soft parts ; hence the midwife must be on the look out for incontinence of urine afterwards, as the bladder is the structure most frequently injured.

Symphysiotomy, or division of the pubic symphysis, and **pubiotomy,** or division of the pubic bone, are sometimes done in cases when the pelvis is just too small to allow of the passage of a living child. The objections to the operation are the risk of damage to the soft parts when the divided pelvis gapes during the passage of the head, and of subsequent lameness of the patient if the union of the pelvic girdle is not sound. There is also considerable risk of hæmorrhage at the time. The operation is not often done in this country, and only in multiparæ, in whom the relaxed soft parts lessen the risk of laceration, and for contraction at the outlet.

The nursing of such cases is very difficult. Great care is required to prevent soiling the wound (which is generally in the labium majus) with the lochial discharge ; the passage of the catheter is difficult as the limbs cannot be separated widely ; a firm bandage round the hips is necessary to assist the pelvic bones to unite. A hospital is the only suitable place for the after-care of patients delivered by symphysiotomy or pubiotomy.

Cæsarean Section is the delivery of the child through the abdomen, and is done in cases in which delivery by the natural passages is impossible without destruction of the child, provided the conditions are such as will not make the risk to the mother too great. The operation is a very simple one. A cut is made through the abdominal wall, exposing the pregnant uterus, the uterine wall is then incised till the membranes are seen and the opening enlarged sufficiently to admit of the child being removed through it ; the membranes are ruptured and the child delivered—generally by seizing a leg ; the placenta and membranes are then removed, the uterine incision carefully stitched, and after cleansing the peritoneal cavity of any clot or vernix which may have escaped into it, the abdominal wall is sutured and the dressing applied.

The risk of the operation in favourable cases and under good conditions is a very small one—under 2 per cent. In cases in which there have been many vaginal examinations and perhaps attempts at delivery with instruments, the risk of infection is greatly increased. Performed under hospital conditions, before rupture of the membranes, and in the absence of vaginal examination or manipulation and under strict surgical technique, the danger is reduced to a minimum. For this reason many obstetricians hesitate to perform the operation if there has been any possibility of infection of the vagina and uterus.

The conditions for which the operation is most frequently performed are obstructed labour from contracted pelvis or tumours blocking the pelvis. It is sometimes done as the quickest and easiest method of delivery in central placenta prævia, serious heart disease, and other conditions in which a protracted labour would be more dangerous to the mother than a Cæsarean section.

Cases calling for this operation rarely arise so urgently that removal to a hospital is out of the question. If so, the midwife must do what she can in the preparation of the room and the patient, and be ready to assist the doctor during the operation. What has already been said as to the preparation of the lying-in room (p. 142) and on general hygiene (p. 299) should be kept in mind and the conditions made as suitable as can be for the operation. A table must be procured, and for this a narrow wooden table long enough to accommodate the patient is the best substitute for an operating table. It must be firm on its legs and not too wide ; often a kitchen table is the best that can be obtained. Small work-tables are very useful for instruments and dressings. If there is time the table should be well scrubbed. In any case, it should be covered with a double thickness of blanket with a sheet over it. It ought to be placed where the best light can be obtained—by the window in the daytime, and under the best artificial light at night.

Below the table there should be spread newspaper or brown paper, or preferably, oilcloth, so as to prevent soiling by blood or blood-stained fluids.

The small tables should be covered with clean towels. Several hand basins

will be required. Besides those for washing, a basin will be needed for lotion for the hands and another for instruments. Smaller ones, such as meat dishes or pudding dishes, for ligatures and swabs will be useful. All these should be thoroughly cleansed, scalded, and washed with an antiseptic solution. Methylated spirit poured into the dish and set alight is a useful method of sterilization. One or two jugfuls of boiled water should be set aside to cool with a towel over them. In any case, all available kettles should be filled and put on to boil. Also a fish kettle or large saucepan should be cleaned and filled with water so as to be available for sterilizing instruments and swabs.

Plenty of wool or other material for swabs should be prepared and sterilized by boiling.

The patient should have an enema, the vulva should be thoroughly washed and cleansed with antiseptic lotion, and a vaginal douche given as the doctor may order. The pubic hair should be shaved and the abdomen prepared according to instructions. A common method is to paint it, the front and sides of the abdomen with a solution of 2 per cent. iodine in rectified spirit—or tincture of iodine may be used—half an hour before the operation, and again when the patient is on the table. No solid food should be given, and the instructions on page 316 followed. Just before the patient goes on the table the catheter ought to be passed. When the patient is on the table, a pillow ought to be provided for her head ; her night-gown can be rolled up on to the chest and a blanket put over her legs, which also ought to be clad in warm stockings.

The midwife must be ready to give what assistance she can during the operation, and in any case must see that a hot bath is ready, as the child may require resuscitation. She must also see that the patient's bed is prepared for her with blankets and hot bottles.

The midwife cannot undertake the after-care of the patient unless she is prepared to devote herself for the time being solely to this patient. She should, however, remain with the patient till some other skilled attendant can take her place, and in any case take charge of the infant.

The mother is generally able to suckle the infant as in natural delivery.

Other abdominal operations may be necessary during labour, as for the removal of ovarian tumours, for fibroid growths of the womb, or for rupture of the uterus. The preparations for such operations are exactly as for Cæsarean section.

The after-care of the patient requires the services of a trained nurse. The most essential points may be briefly mentioned.

First, there is the time during which the patient is recovering from the effects of the anæsthetic and operation. She must be kept warm in bed with hot bottles round her, but every precaution must be observed to avoid burning by the prolonged contact of the hot bottle with the skin. Very troublesome burns which take months to heal may result from want of care in this respect. The unconscious patient does not feel sufficiently to move away from the heat, and even if a bottle is not hot enough to cause a burn by contact with it for a few minutes, it may do serious injury when the contact is continued for long. Hence the bottles are best put outside the blankets covering the patient, or wrapped in flannel bags, or covered with flannel. The patient's head ought to be turned to one side and a towel placed below the head and over the pillow to avoid soiling if the anæsthetic sickness is troublesome.

The attendant must keep her under close observation to see that she does not suffocate before completely recovering consciousness, and especially after vomiting. The patient's general appearance and the pulse must be watched ; a good index of her general condition may be obtained by putting the hand on the face or other exposed part and feeling the warmth of the skin. Coldness of the face is a sign of shock or collapse from hæmorrhage : if the face is warm and of a good colour, all is well. Restlessness is a bad sign. As the patient begins to recover consciousness she will probably ask for a drink ; the loss of blood, the anæsthetic and the mouth breathing during anæsthesia all conspire to cause great dryness and discomfort. It is not good to allow much fluid at first, as it is liable to cause vomiting : tiny sips of tepid water may be allowed, but it is better merely to wash out the mouth at frequent intervals. Saline injections into the bowel are very valuable in combating

thirst as well as in the treatment of shock. Peppermint water to rinse out the mouth or a dentifrice or other mouth wash is often appreciated by the patient as helping to remove the taste and smell of the anæsthetic, especially if ether has been used. With return to consciousness comes the appreciation of pain, soreness, and the many discomforts consequent on the operation and anæsthetic. For this a hypodermic injection or suppository of morphine is frequently ordered, and if so, should be given as soon as the patient begins to show signs of coming round.

After recovery from the anæsthetic the attendant's chief duties are to keep her patient as quiet and comfortable as possible and to continue careful observation of her pulse and general condition. The anæsthetic sickness generally passes off in the course of twelve hours or so, and any recurrence of sickness after this is a serious matter, and should be reported to the doctor. Flatulence and distension are also serious, especially if not relieved by evacuation of the bowels ; sips of peppermint water, sal-volatile, or brandy may help flatulence, and a drachm of bicarbonate of soda in an ounce of water is often effective. Generally an aperient is given on the second or third day, and after that has acted the patient is much better and ready to begin a light diet. Till then it is better not to risk upsetting the stomach by food, though the doctor will naturally be the one to arrange what the patient is to have by mouth.

Vaginal and perineal operations, such as exploration, washing out of the uterus, or injection of glycerine, suture of a ruptured perineum, and so on, are also best done in hospital, but occasion may arise when improvised arrangements must be made at home.

These operations are carried out with the patient in what is known as the " lithotomy position," *i.e.* on the back with the knees drawn up ; only occasionally, if of quite a minor character, they are done with the patient on the left side in the obstetric position.

If an operating table with leg rests is not available the doctor will probably bring a " crutch " (Clover's is the one in common use), which consists of a bar to keep the knees apart with stirrup bands at each end to go round the leg below the knee, and a strap, which goes over one shoulder and under the armpit of the opposite side and is fastened to the bar between the knees so as to hold the legs up towards the trunk. In emergency, or where no such crutch is available, the midwife must improvise some means of holding the legs in position, otherwise one, or better two, assistants will be needed to devote themselves entirely to maintaining the legs in position. A roller towel, if long enough, is very useful for this purpose. One end ought to be fastened by safety-pins to one thigh, round the knee, and the towel passed up the inside of the thigh to under the armpit of the same side and behind the shoulders. It should be then brought down over the front of the other shoulder to the inside of the thigh of that side, and its other end fastened over the knee with safety-pins as before. It should be made tight enough to keep the thighs well flexed on the abdomen. This method tends to bring the knees close together, and when under anæsthesia the patient tends to roll over on to her side. The knees may be kept apart by tying a walking-stick or broom-handle to take the place of the bar of the Clover's crutch. The midwife, as assistant, must be prepared to stand at the side of the patient and hold the knees so as to keep them apart and to prevent the patient rolling over sideways.

Another way of arranging the patient in this position which avoids the tendency of the knees to come together, is to bring the patient, lying across the bed, so that her buttocks are at the edge of the bed, then to flex the thighs on the abdomen, and, by means of a roller bandage tied round each knee and to the rail at the head and foot of the bed, to retain the limbs in the required position. Naturally this can only be carried out if the construction of the bed is suitable, but commonly this is the case.

Besides devising some such means of maintaining the patient in position, the midwife must prepare the bed for operation, if, as is often the case in district work, there is no convenience in the way of an operating table.

As the patient will be across the bed with her buttocks at the edge, fracture boards under the mattress where the patient is to lie, if obtainable, should be used

and other preparations made as described on page 308. A mackintosh sheet covered with a drawsheet is arranged over the edge of the bed so that it hangs down into a slop-pail or other receptacle. The end of the mackintosh in the bed should be turned up so as to catch any fluid that may run back, and placed in such a position in the bed that the patient's sacrum will lie on the turned-over portion. If care is taken that the buttocks project well over the edge of the bed and that the patient's night-gown is rolled up above the mackintosh, the chances of fluids running back into the bed are greatly diminished. As the doctor may wish to sit during the operation, a low chair or stool should be provided. Naturally, also, care should be taken to select that side of the bed which will allow of the best light on the vulva.

Operations for the **Induction of Labour** are usually carried out with the patient in the lithotomy position and it will be necessary to have the legs fixed or held in position. The midwife should be prepared for this, as it is preferable to have the patient anæsthetized because it facilitates the carrying out of strict methods in surgical cleanliness. Labour is commonly brought on by passing bougies between the membranes and the uterine wall or a stomach tube ; or a collapsed rubber bag may be inserted into the uterus, and, after insertion, expanded by filling it with sterile water through a Higginson syringe. If the bag is a rubber-covered silk one, boiling for more than a minute or two is liable to injure it : bougies also will not stand boiling, and indeed become so soft if placed in hot water as to be rendered useless for the time being. The midwife should therefore be careful to obtain exact instructions as to their preparation if that is left to her. A large bag is liable to displace the presenting part, and therefore the doctor ought to be sent for as soon as the bag is expelled. The onset of labour is often slow when bougies are used—two or three days may elapse.

Assistance in the administration of an anæsthetic in emergencies may fall to the lot of the midwife. The responsibility of giving dangerous drugs, such as those used to produce general anæsthesia, must always rest on a fully qualified medical practitioner, but occasions sometimes arise where both anæsthesia and operative interference are necessary at times when, and in places where, the services of one qualified practitioner only is available. In such circumstances the midwife, under the supervision of the doctor, may be called on to undertake the administration of the anæsthetic, for a time at any rate. Generally it will mean that the doctor will get the patient under the anæsthetic, and that the midwife will keep her under while the doctor disinfects his hands and carries out the operation. It is not an ideal arrangement, as anæsthesia requires the undivided attention of one person, and that a qualified practitioner ; but necessity frequently leads to the midwife being called on to take a part for which she is not trained. The midwife, therefore, should have some idea of the principles which underlie the giving of a general anæsthetic. First of all, she should understand that when under the influence of a drug like chloroform to the full degree, a patient is suspended, so to speak, midway between life and death. Consciousness is abolished and the nervous centres so far paralysed that reflex action is absent. If the chloroform was pushed a little farther so as to paralyse the centres governing respiration and cardiac action, breathing and the heart's action would cease. If the amount of chloroform given was insufficient and allowed of the return of reflex activity, involuntary movements of the patient would begin and possibly seriously interfere with the carrying out of the operative procedure for which it was being given. Therefore the patient must have just as much anæsthetic as will keep her in that stage in which reflex action is so far abolished that movement will not occur during painful manipulations, and yet not so far as to affect in any way the higher nerve centres which govern respiration and cardiac action. Happily the woman in labour is proverbial as taking chloroform easily and safely, and poisoning is extremely rare considering the frequency with which anæsthesia is employed in obstetric work.

The drugs used to induce anæsthesia are chiefly chloroform and ether, or a combination of the two, and of them chloroform is by far the more generally adopted. Occasionally a mixture known as A.C.E., in which a small quantity of alcohol is mixed with chloroform and ether, is used. All these drugs are given by inhalation, either by an " open " method, *i.e.* by dropping on to lint, a handkerchief, or towel,

held in front of the patient's face, or by a " closed " method, in which some form of apparatus is fixed over the patient's mouth.

If it is anticipated that an anæsthetic is required, it is always advisable to withhold solid food for about four hours. Water, tea, or beef tea may be given up to an hour before. Dental plates ought to be removed, as they may slip down into the throat and choke the unconscious patient. It is also well if chloroform is given by the drop method to cover the mouth, nose, and cheeks with vaseline or lanoline to prevent burning should a drop by mischance fall on the patient's face. Any tight garments about the neck should be loosened, so that there shall be no hindrance to respiration.

After arranging the pillows comfortably for the patient and reassuring her, the doctor begins by dropping a little chloroform on the mask or towel, and holding this before her mouth and nose so that the air is breathed through it. As it is very important to begin gently and not to frighten the patient by a strong dose, the mask or towel is generally held a little distance away at first and gradually brought closer up to the face. By dropping on more chloroform as fast as it evaporates the patient is made to breathe a dilute mixture of air and chloroform vapour. If she is nervous, it is a good plan to try and make her talk ; this distracts her thoughts and she breathes better. The first sign of the effect of the anæsthetic is generally incoherent talking, sometimes with shouting and occasionally struggling. This results in deep breathing and in the taking in of large quantities of chloroform vapour. It is, therefore, necessary to proceed very cautiously in case of a sudden large dose being taken. The next thing is that the breathing begins to settle down into regular deep respirations, and here again caution is required in the amount of chloroform given ; plenty of air must be allowed, and it is as well to move the towel away from the face every few breaths if the patient is going under quickly. Indeed, a safe rule is to take plenty of time. At least five minutes are required to get the patient to the stage of deep breathing. As she becomes quiet the breathing also becomes quieter and the patient appears just as if asleep. The reflexes are still present, and pinching the skin or the occurrence of a uterine pain will make her call out, move, or strain. This stage is sometimes known as anæsthesia to the " obstetrical " degree, *i.e.* the patient will sleep between the pains but wake up and bear down with each uterine contraction. This degree is used to dull the pains of labour, for the woman does not feel anything even though she wakes up and calls out with each pain, and generally has afterwards no recollection of what happened during this time. In this stage it is, however, important not to talk or discuss matters it may be inadvisable the patient should hear. Sometimes scraps of conversation remain in her memory and may lead to recrimination afterwards. This obstetrical degree is, however, quite insufficient for the performance of any painful operative procedure, as the woman would kick and throw herself about. Indeed, it is actually more difficult to carry out operations under such conditions, for the patient is only partially conscious and cannot control herself. She will pay no attention to anything that is said to her and may struggle and do herself serious injury.

If more anæsthetic is required than merely to dull the labour pains, it must be carried to the full or " surgical " degree, *i.e.* so far as to abolish consciousness and reflex response to painful stimuli. To do this the doctor continues dropping chloroform on to the mask, watching the breathing very carefully all the time. With regular deep breathing the patient's limbs soon become quite flaccid and toneless, so that if an arm is lifted up no resistance is offered and it flops down at once when dropped. This effect of the chloroform in producing complete muscular relaxation is noticed in the breathing, for the cheeks, and lips, owing to the laxity of their muscles, become loose and flutter with each breath, as is sometimes noticed in deep sleep. The usual method of testing the abolition of reflex action is to open the eye and touch the eyeball gently with the forefinger ; if there is no winking response, the reflexes are absent. The patient is now " under " to the full surgical degree and only sufficient chloroform is now required to keep the patient at this stage. Very careful watch must be kept on the breathing, as its becoming shallow or irregular is a signal of danger. The pulse ought also to be watched, though signs of respiratory failure almost invariably precede those of heart failure. It is as well

to look at the pupil of the eye every now and then ; a widely dilated pupil is the result of paralysis of the pupillary nervous centre, and if the pupil does not contract down again when the light falls on it, it indicates a dangerously deep degree of anæsthesia, for the pupillary reflex is one that disappears late.

Should the midwife be asked to continue the anæsthetic after the doctor has got the patient " under," she should carry out his instructions most carefully and report at once any change in the character of the breathing, in the pulse, or in the pupil. A finger should be kept under the angle of the lower jaw, and the jaw pressed forwards and upwards so as to keep the tongue from falling back and interfering with respiration. Blueness of the face is a very serious symptom, and so is pallor of the lips and cheeks. If the patient begins to move, chloroform should not be poured on to the mask, but by a few drops at a time the woman should be gradually brought back to the full degree of anæsthesia required. Probably the doctor will cease from any painful procedure and watch while the midwife does this. Sometimes an inhaler is used by which air is blown through chloroform, by squeezing a rubber ball, to the mask over the patient's face, so that the patient is breathing air containing a small quantity of chloroform vapour. The midwife should watch the rise and fall of the chest with each respiration, and give the rubber ball a slight squeeze just before each rise of the chest so that the patient takes in a small quantity of chloroformed air with each inspiration. If she shows signs of coming round, a stronger squeeze should be given ; if she is well under, and there are no movements, a slight squeeze with every second or third rise of the chest will suffice ; if she appears deeply under, the mask should be removed from the face for a time.

Sickness is likely to occur if the patient comes round, and is sometimes accompanied by faintness : great care must be taken that all vomited matter is cleansed from the mouth and throat, so that nothing is sucked into the windpipe ; the administration of chloroform should not be resumed till vomiting has ceased. If there is warning in the shape of heaving movements and retching, more chloroform should be given so as to get the patient more deeply under, and thus prevent actual vomiting. The midwife cannot be a skilled administrator of an anæsthetic, and all that can be required of her is to give the chloroform as directed by the doctor, and to speak at once should she notice any sign of the patient coming round, for instance, retching or heaving movements of the abdomen, or movement of the limbs, or any change in the patient's appearance, respiration, or pulse which might indicate a dangerous degree of anæsthesia.

The administration of ether and the ether-chloroform mixtures is more difficult, but is conducted on much the same principles as chloroform. Ether is very inflammable, and especially in small cottage rooms is a great danger if there are naked lights about. Special caution is required in its use under such conditions.

The hypodermic injection of morphine, morphine and atropine, or morphine, atropine, and hyoscine (scopolamine), is sometimes used to produce partial anæsthesia. The last-named combination produces an anæsthesia somewhat like that described under chloroform to the " obstetrical " degree. The patient will sleep soundly between the pains, and merely rouse up to bear down as the pains come on and drop off again as soon as the pain has passed off. Should the doctor give an injection of this kind, the midwife must keep the patient under close observation ; sometimes with a strong pain the patient will jump out of bed and wander about in a dazed way.

What has been termed " twilight sleep " is a form of partial narcosis produced by a mixture of morphine and hyoscine. After the first injection of this mixture, frequent injections at short intervals, an hour or thereabouts, of small doses of hyoscine only are given, so as to produce a partial intoxication with hyoscine. The patient becomes drowsy and dazed, and if the administration is successful may go through her labour without having any knowledge or recollection of anything that has happened. It is this loss of memory (amnesia) which is aimed at rather than the abolition of pain. As hyoscine is a dangerous drug, its administration can only be carried out under the constant supervision of a medical practitioner. Should the midwife be in attendance when this method of partial narcosis is adopted, she must keep a close watch on the patient and note the effect on her and on the labour

pains. The room must be kept very quiet and dark, as any noise or strong light will rouse the patient, and nothing must be said or done which may serve to wake her from drowsiness. In such cases it is much more difficult to watch the progress of labour and it may be that it is much more advanced than the attendant realizes, owing to the absence of groaning and signs of distress in the expulsive stage. Sometimes the patient becomes noisy and difficult to control; bearing-down efforts are often diminished or absent. On the other hand, the attendant is saved much expenditure of sympathy and encouragement by word and deed. Thirst is often marked and the patient should be urged to drink copiously; the bladder may become distended without the patient recognizing it, and a catheter is often necessary. The child may not breathe readily when born but generally recovers if kept warm or put in a warm bath without recourse to artificial respiration. In any case the child should be removed from the mother, as its crying may serve to rouse her. In the successful cases the patient sleeps for some hours after labour.

CHAPTER XXXI.

THE RULES OF THE CENTRAL MIDWIVES BOARD.

The pupil midwife must be thoroughly acquainted with the Rules of the C.M.B.[1] There is nearly always at least one question on them in the paper, and at the oral examination there is a copy lying on each table to remind the examiner that questions from it should be asked. The Rules as they affect the practice of the midwife have been quoted extensively throughout this book wherever they pertain to the subject under consideration, and here it will only be necessary to call attention to those points not hitherto mentioned.

The first Midwives Act was passed in 1902, and amending Acts in 1918 and 1926. Since 1905 every woman practising as a midwife must have her name on the Midwives' Roll, and can only do so after undergoing a specified course of training and passing a recognized examination. A Midwives (Scotland) Act was passed in 1915, and a Midwives (Ireland) Act in 1918. The Rules of the Scottish [2] and Irish [3] Boards and for North Ireland [4] follow closely those of the English Board, and it is only occasionally necessary to call attention to differences.

Before being accepted for training, the intending pupil midwife must produce evidence to the institution or approved teacher that her general education is adequate, and before entering for the examination, certificates must be produced to show that the candidate is not under twenty-one years of age, is of good moral character, and has undergone the necessary training. If married, the marriage certificate has also to be produced. The particulars relating to these certificates are given in Section B 2 of the Rules.

The regulations which came into force in 1926 increased the length of training to a year, and for trained nurses (with regard to whom Rule C 1 (2) must be consulted) to six months. There were also several additions to the training and consequential alterations to the certificates required before entering for the examination. Instruction in antenatal care is specified, the certificate for which states that the candidate shall have "examined and received instruction in the supervision of not less than twenty pregnant women (including booking and keeping of records)." Although the number of deliveries to be personally conducted by the candidate has not been increased, new conditions have been laid down with a view to enabling her to obtain a wider experience. It will clearly be to her advantage if, before conducting deliveries herself, she watches the management of labour conducted by others, and later learns by her own experience the application of what she has seen. It is undoubtedly better that the conduct of labour should first be learnt under the easiest and most favourable conditions, as in a hospital or other institution, with everything to her hand; also that before practising as a midwife, she should learn to apply these methods in the homes of the patients, where there may be great lack of convenience for the conduct of labour and much improvisation and many makeshifts may be necessary. For this reason the delivery and nursing of at least five cases in the patient's home is made essential. A further advantage is that outdoor training involves the keeping of a register, the sending of notifications and such like, all of which must be learnt before a woman can practise as a midwife. To embody these improvements in training the certificate (C. I. (1) (*b*)) testifies that the candidate has "Witnessed not fewer than ten labours and in addition attended and watched

[1] Price 6d. Post free, 7½d. Obtained from Messrs. Spottiswoode, Ballantyne & Co. Ltd., 1 New Street Square, London, E.C.4.

[2] Messrs. George Robb & Co., 16 Clyde Street, Edinburgh. Price 6d. Post free, 7½d.

[3] Messrs. John Falconer, 53 Upper Sackville Street, Dublin. Price 1s.

[4] John Adams, King Street, Belfast. Price 6d.

the progress of not fewer than twenty labours, making abdominal and vaginal examinations during the course of labour and personally delivering each patient. (Schedule Form III. (*b*))—Of the twenty patients personally delivered the first five must be attended within an Institution where there is training approved by the Board, and of the remaining fifteen at least five must be attended in their own homes." If the necessary first five are attended indoors, and another five outdoors, the remaining ten may be taken either in an institution or on a district, according as is most convenient. For a like reason the nursing of at least five women in their own homes is also made essential in the certificate of attendance during the lying-in period (Form III. (*c*)).

The exact meaning of " personally delivering the patient " is not easy of explanation. The intention of the term is quite plain ; it is to exclude cases in which the pupil has merely been a watcher—has seen delivery, but has taken no part in it, and also B.B.A.—" born before delivery "—cases.

Each case for which the pupil is signed up must be one which is assigned to her and to her alone ; no other pupil can be signed up for the same case. It must be one which she has had time and opportunity to examine fully, has received instruction on, and personally carried out the management of the delivery.

Difficult points will rarely arise in the interpretation of this rule, but one may be mentioned. Ought a case to be excluded which the pupil has watched and examined, but has required medical help—for example, instrumental delivery—so that, according to the letter of the law the pupil cannot be said to have " personally " delivered the patient ? The spirit of the regulation does not mean such cases to be excluded from the pupil's twenty labours—indeed, it would be a great disadvantage to the training of midwives if such cases were not counted. It would be a mistake to discourage the training of pupils on the very cases they must recognize in practice—those for which medical aid may be necessary—so cases of pelvic contraction, transverse lie, antepartum hæmorrhage, and so on, which the doctor in attendance " personally delivered " but which the pupil had watched, examined, received instruction on, and in which she had perhaps given some assistance during delivery, need not be excluded. The gist of the matter is—that each candidate must be signed up for twenty labours attended over a period of at least three calendar months—that is, not crammed into a portion only of that period and that on each of these twenty labours she must have had full opportunities of watching and examining the patient and conducting the delivery, *so far as that falls within the province of the midwife.* It is unsatisfactory, however, if the pupil has more than two or three operative cases among her twenty.

These cases must be completed before the signing of the certificate ; and in order that some check may be kept on the signer of the certificate and on the pupil, the name of the patient, her address, and the date of delivery must be entered on the back of the schedule. The candidate must countersign the schedule, and she ought not to do so unless she is satisfied that the regulations of the C.M.B. have been properly fulfilled. The responsibility of checking the correctness of her schedule, even to the names and addresses of the patients, and dates of delivery, as vouched for on the back, rests with her as well as her teacher.

A separate certificate is required for the nursing of twenty lying-in women and their infants. The nursing and attendance on labours may be done at different periods and on a different series of patients, thus conforming with the usual custom of a large maternity hospital of the training in monthly nursing being given before that in the labour ward. It is better for a pupil who has had no previous nursing training, to learn the care of the mother and infant first, and afterwards the more difficult problem of the management of labour and the detection of its abnormalities. During the training in monthly nursing, she must learn how to take the pulse and temperature, watch her patients and make observations and reports, acquire familiarity with the technique of surgical cleanliness, and how to carry out such procedures as giving a douche and passing the catheter.

Form IV. of the schedule certifying to the attendance on not less than thirty lectures must be filled in and signed by a registered medical practitioner recognized by the C.M.B. as a teacher. The rules state that the course must embrace the

subjects of examination as named in Section C (5), extending over a period of not less than four calendar months. The lectures are intended to be spread as evenly as possible over this period, and in no circumstances will the Board allow more than one lecture in one day to be counted, nor are " demonstrations " to be considered as lectures. The usual hour ought to be given to each lecture. Again, the pupil must see that the course is completed by the date of signing the schedule, and not that it will be completed by the date of examination.

A most difficult part of the training, and one that cannot be laid down in any regulations or tested by written or oral examination, is to teach the pupil to take responsibility and acquire self-reliance—qualities essential for success as a practising midwife. When the new regulations and the lengthened training are in force the acquiring of these qualities will be made easier. At first the pupil requires close supervision by her teachers, but as the methods of conducting labour are learnt, the supervision should gradually be relaxed, so that it can be seen how far she can be trusted. The more the teacher can keep her supervision in the background, and the more she can leave to the advanced pupil, the more self-reliant and capable will be the midwives she trains. It should be the earnest endeavour of every pupil midwife to obtain the confidence of her teacher by showing her capacity to rise to the occasion under increasing responsibility ; only thus can she develop the qualities necessary for the practice of her profession. The teacher alone can judge how far the individual pupil can be safely trusted, but, before her twenty deliveries are completed, she should be able to conduct the delivery alone with the teacher within easy call should assistance be required.

It is also of the utmost importance that the keeping of registers and records, the sending of notifications and the other duties of the practising midwife should be made part of the training. These matters and co-operation with local voluntary associations for maternity and child welfare and other agencies for the care of mother and infant will be most easily learnt by work in an outdoor district, and the regulations making some district work compulsory should enable the newly certificated midwife at once to take her place in the health service of the country.

Having completed the course of training, the candidate must send notices to the Secretary of the C.M.B.[1] at least four weeks before the date fixed for the examination to commence, *i.e.* the date of the written paper, together with the prescribed fee and her schedule with the various certificates filled up and signed. Each candidate accepted for examination is given a card of admission to the written examination, and at the written examination she will receive another card to admit her to the oral examination. It is imperative that these cards be brought to the examination, as any candidate without a card is liable to exclusion (Rule C 4).

On passing the examination, the candidate becomes a midwife and receives a certificate (Form II. of the schedule) to say that she is entitled by law to practise as a midwife in accordance with the provisions of the Midwives Act, and subject to the said rules and regulations, *i.e.* those in Section E, " Regulating, supervising, and restricting within due limits the practice of midwives."

Every candidate for the examination and every practising midwife must know the rules and understand their application to practice. That is one of the reasons why attendance on outdoor cases is made compulsory and is so valuable to the pupil, because hospital practice affords no opportunity of learning how the rules affect the work outside. If the midwife when she begins practice does not fully understand any of these rules it is her duty to consult her inspector and have all her doubts and difficulties cleared up ; also to keep herself abreast of any alterations and additions that may be made from time to time. If cited to appear at a Penal Committee of the C.M.B., it is useless to plead ignorance, for it is as much her business to understand the rules as to know how to conduct a labour. Ignorance of the law does not excuse.

A point regarding E 20 and 21, the two rules stating conditions in which medical help must be sent for, is sometimes misunderstood. The first four lines in E 20 govern all that follows in that rule and in E 21 : " In all cases of *illness of the patient*

[1] 1 Queen Anne's Gate Buildings, Westminster, S.W.1 ; the C.M.B. for Scotland, 49 Lauriston Place, Edinburgh ; the C.M.B. for S. Ireland, 33 St. Stephen's Green, Dublin ; Joint N. and Midw. C. for N. Ireland.

or child or of *any abnormality* occurring . . . etc." medical help must be sent for. It is made absolutely clear by the note at the end of E 21, where it is specifically stated that the lists given are not exhaustive and do not include all cases in which medical aid should be summoned. Yet midwives occasionally think that if the specific condition is not mentioned in E 21 they need not send. If they thought the matter out, they would quickly realize that it is impossible to make any hard-and-fast list and remove all need for the exercise of judgment on the midwife's part. For one thing, it is very often not one condition but several that taken together lead to medical aid being sought. The rules interpreted in a broad sense should give any well-trained midwife a clear lead as to what she has to do, and when she has any doubt her discretion will tell her that it is safer to err on the side of calling medical advice.

When the midwife begins practice in a district she must, " before holding herself out as a practising midwife or commencing to practise as a midwife in any area, give notice in writing of her intention to do so to the local supervising authority [1] . . . and shall give a like notice in the month of January in every year thereafter during which she continues to practise in such area." The notice must be given in the prescribed form (Schedule Form VIII. (XII. Scotland)), and contain the particulars specifically mentioned in Section G. She must also give notice of any change of name or address to the Secretary of the Central Midwives Board as well as to the L.S.A. Registered as a midwife and having given the statutory notice, she is now in a position to practise. The rules give her proper mode of designation as :

MARY SMITH,
Certified Midwife.

In order to avoid any suspicion of the midwife attempting to make her patients think she possesses a medical qualification, the rules specially state that " no abbreviation in the form of initial letters is permitted, nor any other description of the qualification " (Section E 28).

The difference between a certified midwife practising as a midwife and one practising only as a maternity nurse under a doctor is not always clear, and, therefore, the C.M.B. has given definite rulings at the beginning of Section E,[2] from which it is clear that a certified woman practising as a maternity nurse, if not actually residing at her patient's house, may by accident have to act as a midwife, and, therefore, it is advisable that she should notify the L.S.A. of her intention to practise. If she has not done so and should, owing to the non-arrival of the doctor, have acted as a midwife, then she must make a special notification on each occasion on which this happens.

The L.S.A. is given the power of inspection of every practising midwife in its district, and the midwife must give every reasonable facility for inspection of her

[1] After this described by the initials L.S.A. The L.San.A. is the smaller body under the L.S.A., *e.g.* metropolitan borough councils under the London County Council, and district and urban councils under county councils. The term L.San.A. applies to so many different bodies it is impossible to define it, and therefore the midwife is advised to apply to her Inspector of Midwives in the event of her not knowing the sanitary authority who should be notified.

[2] " A woman whose name is on the Midwives' Roll is acting as :

" A. A MIDWIFE, and is subject to the rules, and is bound to notify the Local Supervising Authority of the fact under Section 10 of the Midwives Act, 1902 :

" (*a*) When she has been engaged to deliver the patient ;

" (*b*) When sent for in an emergency, no doctor having been engaged ;

" (*c*) When a doctor makes an arrangement with a midwife engaged as a Maternity Nurse that he is not sent for unless she requires him ;

" (*d*) When a doctor arranges with a midwife that she shall deliver patients for him ;

" (*e*) When a doctor has been engaged to deliver the patient and she has sent for him on the onset of labour, but she leaves the house after delivery before he arrives.

" *Note.*—The case should be entered in her Register in the usual way, and in (*c*), (*d*), and (*e*), the date on which the case is handed back to the doctor and her position as a nurse resumed.

" B. A MATERNITY NURSE, and is *not* subject to the rules (except Rules E 6, 19, 22 (1), (*d*) and (*e*), 22 (2), 23 (*d*) and (*e*), and 28) :

" When a doctor has been engaged to deliver the patient and she has sent for him on the onset of labour and he arrives before she leaves the house.

" If these conditions are not fulfilled she is subject to all the rules."

house, bag, appliances, register of cases, and of inquiry into her methods of practice (E 25). The register of cases must be kept in the form prescribed (E 24), and the midwife must note in it each occasion on which any drug other than a simple aperient has been administered or applied, stating its nature and the dose given, the reason for it, and the time (the stage of labour) (E 19). Information regarding drugs will be found in Chapter XXIX.; here it is only necessary to say that although the C.M.B. makes no mention of the drugs that the midwife may or may not give, the use of such a drug as chloroform should be looked on as coming within the instruction at the end of Rule E 7.[1] On the other hand, as avoidance of fatigue is essential to the prevention of inertia and instrumental interference, treatment by some sedative drug, of which opium is by far the most valuable, should have been taught to the pupil. In Scotland, however, a midwife apparently cannot be taught to measure out a few drops of laudanum without assistance from a doctor, and in that otherwise enlightened land the patient's relief must be delayed, and the local rates must pay for this supervision in accordance with Rule E 19, which runs :

"No midwife shall administer or apply any drug (*e.g.* pituitrin or ergot) before the birth of the child, other than a simple aperient, unless on the instruction in each case of a registered medical practitioner, called to her assistance by using for this purpose the form of sending for medical assistance (see Rule 23 (*a*), p. 26), properly filled up and signed by her."

The L.S.A. must be notified on the prescribed forms given in Section E 23 in the following cases :

1. *Medical Help.*—"Whenever the advice of a registered medical practitioner has been sought." After the name and address of the patient the form has a space for the midwife to give the doctor the reason for her advising that his help is required. Every effort should be made to make this as informing as possible to the doctor. The complication or abnormality should not only be stated, but the stage of labour, the pulse, and general condition of the patient. There is a line, "The case is urgent," which is to be crossed out if it does not apply. By taking a little trouble to explain the case fully, the midwife will be of greater help to both patient and doctor, and will acquire a reputation with the local medical profession which will always stand her in good stead. The form of sending for medical help is filled up in triplicate. One copy is kept by the midwife as her own record, one is sent to the medical practitioner, and the third she must send to the L.S.A. as soon as possible.[2] The midwife should observe strictly the method of carrying out this rule, as it is partly designed for her own protection. Suppose, for instance, a doctor is not obtained, from the message miscarrying, or other reason. If the L.S.A. duly receives the form and the midwife has a duplicate, there is proof of her having fulfilled the regulations. She has not fulfilled her obligation in merely obtaining medical aid ; she must also inform the L.S.A. that she has done so, so that further assistance may be given to the patient if her condition calls for it.

2. *Deaths.*—"In all cases of the death of mother or child."

Any case in which a death occurs without the patient, mother or child, having been previously seen by a registered medical practitioner will be the subject of a coroner's inquest. The midwife should at once make very full notes of the case while it is fresh in her memory, as these may be of value to her in an inquiry. Death of the mother before she has been seen by a doctor, must be extremely rare in this country, unless the midwife has overlooked the warnings of impending disaster or in a few rare and sudden calamities, but the newborn child may die suddenly or with little warning, and possibly without the midwife having seen any reason to advise the attendance of a doctor. It is necessary again to impress on the midwife the advisability of erring on the side of caution, and, in any case in which she has any suspicion of feebleness of the infant, of summoning medical aid and so ending her responsibility in the matter. Sections E 20 and 21 (5) give specific instructions in regard to the child.

[1] "*Note.*—Midwives must not, except under a grave emergency, undertake operative procedure or any treatment which is outside their province. The question whether in any particular case such procedure or treatment was justified will be judged on the facts and circumstances of the case."

[2] "If for any reason the services of a registered medical practitioner be not available, the midwife must, if the case be one of emergency, remain with the patient and do her best for her until the emergency is over. After having complied with the rule as to the summoning of medical assistance, the midwife will not incur any legal liability by remaining on duty and doing her best for her patient" (E 7).

3. *Stillbirths.*—If a doctor is not in attendance at the time of birth, important duties devolve on the midwife regarding stillbirths. The difficulty has been to say what is *not* a stillbirth, as premature non-viable fœtuses ought to come under abortions and not stillbirths, until, in its wisdom, Parliament rushed in where angels fear to tread and decided the matter for all time, in the Births and Deaths Registration Act, 1926.[1] The important points so far as the midwife is concerned are to be found in Rule E 22 (p. 31 of the Rules). It will there be found that a child that breathes or shows any signs of life after birth, *whatever the period of pregnancy reached*, must be regarded as a live-born child, and both birth and death must be registered. It must not be forgotten that even tiny non-viable fœtuses may move, gasp, and squeak for a few hours after birth. Should a fœtus born *before* the twenty-eighth week show no signs of life, then it is allowed by Act of Parliament to be really an abortion and need not be registered. If there is any question as to the pregnancy being far enough advanced for a viable child to be born, the best and safest plan for the midwife is to consider the case as one of abortion and not premature labour (p. 206). Send for a medical practitioner, and give only emergency aid.

If, *after* the twenty-eighth week of pregnancy, however, the fœtus do not breathe or show any signs of life, it is a "stillbirth," and must be registered. The midwife has then three duties: (1) Give the relatives the prescribed certificate of stillbirth, if she was present at the birth (without which the body cannot be buried); (2) in accordance with E 22 (1) (*c*) (*a*) notify to the L.S.A. on Form (Rule 23 (*c*)) of the occurrence of a stillbirth; and (3) whether a doctor is present or not, send within thirty-six hours to the medical officer of health of the district (L.S.A. or L.San.A.) notification of the birth (see below).

Besides filling in these particulars in the form and writing the case up in her register, the midwife should here also be particular to make at once most careful and full notes. She cannot tell when further investigation may not be made, and, if she is blameless in the matter, a detailed report of her case is the best safeguard she can have. For instance, it might happen that an unusual proportion of stillbirths occurred at one time in her practice. Naturally, the L.S.A. would send its inspector to investigate, and though none of them was in the slightest degree the fault of the midwife, the mere fact of there having been an unusual number in her practice would put her on her defence. Her register of cases carefully filled in, and full notes of the patient's history and her own observations during the labour, are the best possible evidence of her practice and of her management of her cases. She might, for instance, have found the cord round the child's neck or body in one case, or the child peeling in another, with a history of the mother having noticed cessation of movements for a week or so before delivery. Naturally, a premature child is more likely to be stillborn than a full-time one, and in such cases not only should careful notes be made of the mother's dates—so as to calculate the intrauterine age—but the weight and the measurements of the length of the child (as the best evidence of its development) and any signs of prematurity (p. 280) should be noted.

4. *Laying out the Dead.*—In all cases in which she has prepared, or assisted to prepare, a dead body for burial, particulars must be sent on the prescribed form, giving the name, address, age, and cause of death of the deceased person. This notification is necessary because the practising midwife is prohibited from laying out the body of any patient on whom she had not been in attendance at the time of death, and because she must undergo adequate cleansing and disinfection as the L.S.A. may think necessary in the circumstances (Rules E 18 and 6).

5. *Liability to be a Source of Infection.*—The midwife must notify the L.S.A. whenever she has been in attendance, whether as a midwife or a **nurse,** upon a patient, or in contact with a person, suffering from puerperal fevers or from any other condition supposed to be infectious, or is herself liable to be a source of infection (E 6). She must (unless the L.S.A. relieves her from that obligation) disinfect herself and all her instruments and other appliances, and have her clothing thoroughly disinfected, to the satisfaction of the L.S.A., before going to any other maternity patient.

[1] These regulations are designed to afford statistics of value and by international agreement to secure uniform systems of registration, so as to make the figures from one country comparable with these of another.

Unless otherwise directed, all washable clothing must be boiled, and other clothing must be sent to be disinfected by the local sanitary authority (see note to Rule E 6). The L.S.A. has the power under the Act to suspend the midwife from practice when necessary for the purpose of preventing the spread of infection, and the conditions under which this suspension may be exercised are explained in Section F.

6. *Artificial Feeding.*—Whenever it is proposed to substitute artificial feeding for breast feeding.

The part of Rule E 12 stating that if the midwife after ceasing attendance returns for any reason to look after mother or child for any illness connected with the confinement, then all rules under Section E (in so far as they are appropriate to the case) shall apply, is easily overlooked. All such visits should be entered in the register.

All midwives, whether practising or not, must immediately notify the L.S.A. and Secretary of the C.M.B. of any change of name or address.

Section D gives the procedure to be followed on the removal of a midwife's name from the roll for any offence or disobedience to the rules, and for application for the restoration to the roll of a name removed, and requires no consideration here.

The only other points in regard to the rules to which attention ought to be directed, are the pages on ophthalmia neonatorum, gonorrhœa, syphilis, cancer of the womb and breast, and pemphigus neonatorum, all of which must be carefully studied. The practising midwife is recognized as one who will often be consulted by her patients on other matters than those strictly within her sphere, and the leaflets on ophthalmia, venereal disease, and cancer are good instances of the assistance which is expected of the midwife towards improving the knowledge of hygiene and health principles among the poor. It is by advising her patients not to neglect in themselves and their children symptoms that may appear trifling, that the midwife can help to improve the health of the community in addition to all she may do in the child-bed itself. The Rules also urge her to co-operation with health visitors and maternity or child welfare centres as may be provided for in her locality (see note to Rule 12A). Another way in which her help has been sought is the duty which is put on her by the Notification of Births Act (1907) of seeing that every birth (and stillbirth) in her practice is notified to the Medical Officer of Health of the District (L.S.A. or L.San.A.) in which the birth occurs, within thirty-six hours, with the name and address of the parent.

CHAPTER XXXII.

VENEREAL DISEASE.

Among the subjects of examination as laid down by the C.M.B. is "The Venereal Diseases (Syphilis and Gonorrhœa) in women and infants, their signs, symptoms, and dangers, and the risks of contagion." These diseases are usually acquired by sexual connection, and when so acquired affect the genital organs in the first instance. Other parts of the body than the genital organs may, however, be accidentally inoculated, and the infant may be affected by inherited disease or may be infected at birth.

Gonorrhœa, syphilis, and soft sore form the three varieties of venereal disease.

Gonorrhœa is caused by infection with an organism, the gonococcus (p. 26, and Fig. 15), which infects the moist mucous membranes and gives rise to a purulent secretion. In women, most commonly the vulva, vagina, and the vulvo-vaginal glands are first involved. The infection may spread upwards to the cervix, where it is liable to become very chronic, as the gonococcus penetrates deeply into the mucous glands and so is difficult to reach with antiseptic applications. From the cervix the disease may spread to the body of the uterus (causing endometritis) and from there along the mucous membrane of the Fallopian tubes (causing salpingitis) to the peritoneal cavity (causing inflammation—peritonitis) and abscess in the pelvis, with consequent invalidism and sterility, and often requiring serious abdominal operations for their cure. In rare cases the urethra is affected and an upward spread of the infection may lead to cystitis (p. 248); occasionally also the rectal mucous membrane may be involved. Some of the infective matter may be carried by the fingers to the eye and so inoculate the conjunctiva (the membrane lining the eyelids and covering part of the eyeball). It is this possibility of infection of the eye that makes gonorrhœa so serious a complication of labour to the infant, for if any of the discharges get into the infant's eye at birth, the most severe form of the ophthalmia of the newly born (p. 293) is set up.

To the mother a gonorrhœal discharge is a serious addition to the risks of childbed, for the opening up of the genital canal may result in an upward spread of the disease and even a puerperal septicæmia. It is rare, however, for the disease to infect the blood; generally it only spreads locally along the mucous membranes, but occasionally it gives rise to a low form of septicæmia and to infection of the joints (gonorrhœal rheumatism).

The acute stage of the disease is easily recognized. The vulva is swollen and red, and so tender that both walking and sitting are painful. There is a profuse yellow mattery discharge from the vagina, and on opening the labia the vaginal walls are seen to be raw, red, and weeping. Often the meatus of the urethra is red and pouting, and there is a red, inflamed area at the opening of the vulvo-vaginal glands in the groove between the labia minora and the hymen. The skin round the vulva will be irritated by the discharge and appear red. There may also be enlargement and tenderness of the glands in the groin. If the urethra or meatus urinarius is involved, the patient will complain of scalding and pain on passing water. The midwife is, however, not likely to meet with cases of recent or acute infection, and, unfortunately, the disease is not easily recognized when it has become chronic. The redness and swelling of the parts will have disappeared and the presence of a yellow discharge will probably be the only sign, though a history of the previous acute stage may be obtained. Also, the irritation of the long-continued discharge on the skin sometimes produces a crop of warty growths round the vulva and rectum, and these "gonorrhœal warts" may be taken as a fairly certain sign. The presence of a

purulent discharge in the pregnant woman or in the woman in labour is a complication for which the C.M.B. lays down that the midwife must obtain medical advice. In a case in which labour was advancing rapidly an antepartum vaginal douche of 1 in 3000 perchloride of mercury should be given and the directions as to the management of the child's eyes very carefully followed (p. 293). The midwife must also take great care that she does not infect her own eyes or those of the baby or other babies, and must cleanse and disinfect her hands very thoroughly. The only safe plan is to use rubber gloves while attending to any case of possible gonorrhœal infection.

Syphilis is caused by a corkscrew-like organism, the *Spirochæta pallida*, which obtains entrance to the body through some slight abrasion of the surface or perhaps even through very thin skin or mucous membrane, and is always communicated from other cases of the same disease. At the spot of inoculation a sore (the primary chancre) appears in the course of a few weeks, and, later, evidence of the general infection of the body (secondary and tertiary stages). Naturally, the primary site of infection is usually the external genital organs, but in rare cases it may be on the fingers, especially in doctors, midwives, and nurses, on the lips, or face, from use of infected cups, pipes, or from kissing, on the nipple of a wet nurse from suckling an infected child, and so on. The primary chancre and the other manifestations of the disease are the same whether the infection is a genital or an extra-genital one. Syphilis has been likened to a long-drawn-out infectious fever. There is a period of incubation lasting from the time of infection to the first sign of disease (the primary sore); instead of this being two or three days, as in scarlet fever, it is three to six weeks. Then there is another similar period of gradual development as the rash comes out, with slight fever, sore throat, and a feeling of illness. Then, if untreated, the disease will slowly subside, but relapses may occur and serious late sequelæ may follow for years, and even to the end of the patient's life. The disease is thus divided into the following stages :

An incubation period; from the time of infection to the development of the primary sore (three to six weeks).

The primary stage; the development and induration of the sore up to the enlargement of the nearest lymphatic glands.

The secondary stage, in which the constitutional symptoms develop, namely, the rash, sore throat, joint and bone pains, etc. (six months to two years).

The tertiary or late stage, which may begin from six months to many years after the primary infection, in which swellings (gummata) appear on the bones, skin, or internal organs, with ulceration and destruction of tissue. By this stage the infectious character of the disease has generally died out.

It is necessary very briefly to consider each of these stages. A purely syphilitic infection will show no signs for three to six weeks, and then a small irritable papule will appear at the site of inoculation and will break down into an ulcer (the primary chancre). The ulcer is painless and generally single and may be very small, and is, therefore, especially in the female, liable to pass unnoticed. Its most common site is at the entrance to the vagina, somewhere about the hymen, or on the labia or vaginal walls. In infections away from the genital organs, such as accidental inoculation of the fingers, the sore most commonly forms round the nail or on the pulp of the finger. Here also the infecting sore may be so trifling as to be unknown to the patient. In the course of a week or two the ulcer becomes hard and gristly, this induration forming a very characteristic feature of the primary sore, from which it obtains its name of the "hard chancre." The induration of the sore is shortly followed by the nearest lymphatic glands becoming enlarged, hard, and "bullety." In the ordinary genital sores the glands in the groin will be affected, in finger infections it will be the glands in the axilla, and so on. The characteristic of the glandular enlargement is that each gland can be felt hard and movable like a bullet and usually not painful. This glandular enlargement is followed by the signs of the general diffusion of the syphilitic poison throughout the body marking the secondary stage. These are slight illness, headache, and pains in the bones and joints, with perhaps a small rise of temperature, anæmia, and a feeling of ill-health. Very soon a rash appears; at first it is a general redness (roseola) of the skin—over the chest

and abdomen, on the arms and legs, and on the forehead. The rash becomes spotty and here and there may be a little scaly on the surface (the squamous syphilide). At first it fades under pressure of the finger, but later on does not do so completely, but leaves a yellowish stain, due to slight hæmorrhage under the skin. It is this that gives the coppery colour to the rash. To recognize a secondary syphilitic rash the following characteristics should be looked for. The *distribution of the rash*—most frequently on the front of the body and arms and legs ; on the forehead just below the hair is a common site. The rash is generally *symmetrical*—on the front of both arms, or equally distributed over the front of the chest. There is *no pain or itching*, and often the rash has *different characters in different places*—that is, it may be merely a general redness in one place ; elsewhere there may be small pimples with a scaly top or pustules or vesicles, and so on. A *coppery or lean ham* colour is very suggestive of syphilis. Cracks and ulcers of the lip and skin at the corners of the mouth and of the skin at the nostrils are not infrequent. The appendages of the

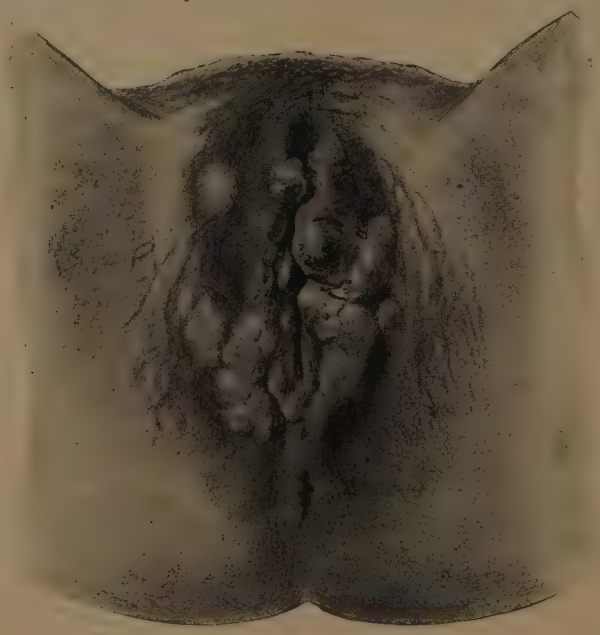

FIG. 119.—SYPHILIS OF THE VULVA.

A primary sore (hard chancre) is seen on the upper part of the left labium majus. Round the vulval opening, especially on the outer surfaces of the labia majora, are numerous raised white patches (condylomata).

skin, the hair and nails, may also be affected—indeed, falling of the hair is a very frequent symptom of secondary syphilis.

The mouth and throat are also affected. The tonsils and throat are reddened and frequently there are white winding patches—like snail crawls—on the tonsils ; ulcers on the edge of the tongue, on the inside of the mouth, and on the palate and tonsils are frequent. Raised white patches, known as *mucous patches*, if seen, are very characteristic. Hence *sore throat* is a common accompaniment of secondary syphilis and, in the absence of treatment, persists for a much longer time than is usual with the ordinary sore throat. The eyes may be affected, and general enlargement of the glands of the neck and the lymphatic glands generally also occurs. Perhaps to the midwife, however, the most suggestive sign of active secondary syphilis is the appearance round the vulva of what are known as *condylomata*. These are really the same as the large papules, with scaly surfaces seen on the dry parts of the skin. On the moist parts of the skin—about the vulva and anus and between the cleft of the buttocks, in the armpits and below the breasts in women with pendulous breasts who perspire freely—instead of being scaly they form raised flat patches

covered with a whitish surface exuding a little thin discharge. These condylomata are exactly similar to the mucous patches already described as occurring in the mouth and on the throat. They are extremely infective, and if the midwife, in washing up and examining the vulva, sees these raised white patches between the labia or round the anus and between the buttocks, she must be extremely careful to avoid infecting herself. Two or three months generally elapse from the date of infection till the secondary symptoms are fully developed, and two weeks or two months from the appearance and hardening of the primary sore. It is not possible to state definitely the duration of the secondary stage itself, because it varies greatly with the severity or mildness of the attack and according to the treatment adopted. From six months to two years may be said to be the duration of the secondary stage, and during this period the symptoms tend to disappear and the disease tends to become less infective. After the disappearance of the secondary stage, if disease has not been effectively treated, lumps may appear on the bones and internal organs, ulcers may break out on the skin and mucous membranes for many years afterwards ; these are known as the tertiary symptoms.

The tertiary stage is of indefinite duration, as symptoms may occur any time in the life of a syphilitic patient who has not been completely cured, though the disease by this time has probably entirely lost its infective powers. It is in this stage that the " dreadful consequences " mentioned in the leaflet printed on p. 69 of the C.M.B. Rules (p. 66 of the Rules of the C.M.B. for Scotland) may occur if the disease has not been treated early and efficiently.

So long as active syphilis is present the woman is liable to abortion, premature labour, or to give birth to a dead macerated fœtus or a syphilitic child. As the poison becomes weaker with time it is said that the characteristic effect of syphilis on the pregnancies is that at first early abortions occur, then abortions later in the pregnancy, then premature labour with a dead child, labour at term with a macerated fœtus, and finally the birth of a living child which develops the signs of congenital syphilis. Such a typical history is, however, rarely obtained in practice, but it is worth quoting as illustrating the effect of the syphilitic poison in producing death of the ovum ; early in pregnancy when the poison is most active, and progressively later as the poison becomes less active.

Inherited or Congenital Syphilis.—Syphilis may occur in infants as an inheritance from either parent before birth, apart from the possibility of its being acquired by inoculation at or after birth. In such cases there is no primary sore, as there is no spot where inoculation has occurred, for the poison has passed into the tissues of the infant at conception or during development. Usually the infant appears in good health and good condition when born, but in the course of three or four weeks suffers from running at the nose, commonly termed " snuffles," with a skin eruption and the ordinary symptoms of secondary syphilis as described for the acquired form. The child becomes fretful and wastes, and its general health is seriously affected ; many infants die from the inherited disease. The rash in affected infants has much the same characteristics as in adults—it is symmetrical and has different characters in different places and is often of the raw ham or coppery appearance. Owing to the irritation of the motions and urine, the buttocks and thighs are specially liable to be affected, as also are contiguous surfaces of skin, like the groins and armpits. Mucous patches and condylomata may be present. Tenderness of the bones and joints is generally present, and when once the disease is well marked and wasting has occurred, the infant often shows that shrivelled " old man " appearance which has been described as characteristic of the disease, but is seen also in other conditions accompanied by wasting. The midwife must remember that it is rare for a child to be born with the signs of the disease, and that these signs will not, as a rule, appear till some time after her attendance on mother and child is over. A rare exception to this is the syphilitic pemphigus (p. 297, Fig. 117) which may appear within a few days of birth.

One curious fact, known as *Colles's Law*, should be mentioned. A mother not apparently suffering from syphilis may suckle her baby suffering from congenital syphilis without acquiring the disease. A wet nurse suckling the same infant would in all probability acquire a primary sore on the nipple. In the active stage of in-

herited syphilis the danger of infection to all except the child's mother is as great as in the acquired form. This is said to be due to the mother having been infected without exhibiting any obvious signs and so not being liable to reinfection.

Soft Sore.—The third variety of venereal disease is an ulcer which is almost never seen away from the genital organs and in which the infection remains purely local and does not spread into the blood and the body generally, as in syphilis. The soft sore differs from the syphilitic sore in the following particulars. It appears within a few days of infection and does not become hard and indurated ; it generally has a greyish-white base with soft sloughy edges, and has a profuse purulent discharge. The soft sores are frequently multiple ; for instance, it is common to see them on the inner surface of the labia on both sides. They cause considerable œdema and swelling of the vulva, and the glands of both groins become enlarged and tender, but not as hard as in syphilis. In any case where there are sores of the genitals the midwife will obtain medical advice (Rule E 21 (2) and (3)).

It will be well before leaving the subject of venereal disease to summarize certain points which the midwife must specially bear in mind.

Though there are three different forms of disease described, all three may be acquired and be present at one and the same time. After an impure connection, a patient within a day or two may have a gonorrhœal discharge and soft sores, and in the course of a few weeks develop the signs of syphilis.

Any part of the body may serve as the point of entrance for the poison of syphilis. Gonorrhœa can only be inoculated on to mucous membranes, and besides the genital tract the only other likely part to be infected is the conjunctival membrane of the eye ; the soft sore occurs only on the genital organs. Syphilis is the only disease which may be transmitted to the child, though the infant's eyes may be inoculated with gonorrhœa at the time of birth or afterwards.

In any case in which the midwife has reason to suspect the presence of venereal disease she should wear indiarubber gloves for her own protection, and if there are purulent discharges or sores of genitals, medical advice should be obtained in accordance with the regulations of the C.M.B.

In gonorrhœa and soft sore the discharges only will cause infection ; in syphilis not only are the discharges from the sores infective, but also the saliva from the mouth, the blood, and possibly all the fluids of the body. Hence great care must be taken in nursing syphilitic patients, mother or infant, and all sponges, towels, cups, spoons, and such-like kept solely for the patient's use and carefully boiled or disinfected afterwards.

The midwife should possess sufficient knowledge to urge women or their children whom they may suspect to be suffering from any form of venereal disease to seek skilled medical help, and in this way to help to fight a great evil. The C.M.B., however, warns the midwife not to express an opinion even by word alone that any one is suffering from gonorrhœa or syphilis, as it may expose her to legal proceedings. It is not her function to diagnose any of these diseases, but only to obey the rules and advise medical aid in the circumstances mentioned : " purulent discharge," " sores of the genitals," when the previous pregnancy " has ended in abortion, a premature labour, or a stillbirth," " inflammation of or discharge from the eyes," however slight, and " serious skin eruptions " in the child, etc. (see pp. 66 and 72 of C.M.B. Rules, p. 63–68 of C.M.B. for Scotland).

CHAPTER XXIII.

CANCER OF THE WOMB AND BREAST.

LEAFLETS on these subjects have been drawn up and issued by the C.M.B. and will be found on pages 73 and 75 of the Rules (pp. 70 and 72 of C.M.B. for Scotland), and should be studied carefully.

Cancer of the Womb.—Women frequently consult the midwife who has helped them in childbirth about irregular losses and vaginal discharges, and, therefore, the midwife may have great influence in persuading such women, when they seek her advice, to go at once to a qualified medical practitioner for examination, because these losses and discharges are the first symptoms of cancer of the uterus. There are certain matters about this dread disease which the midwife ought to know. The cervix is the part most commonly attacked. The disease begins there as a small growth, which generally soon ulcerates on the surface and gives rise to bleeding and discharge. If the part is removed at an early stage of the disease, while the growth is still small, the disease can be cured ; if it is neglected until the growth has spread and seeded itself into other parts so that removal is impossible, the disease is invariably fatal. Therefore no time should be lost if the patient's life is to be saved.

The reason why so many women die of cancer of the uterus is that they do not come early enough to the doctor. They do not come early because at first cancer of the uterus causes no pain and no disturbance of the general health, and sometimes very trifling symptoms of any kind. When pain is present it generally means that already the disease has gone too far for removal, and that the nerves and other sensitive structures in the pelvis have become involved. When the patient looks ill and wasted, it shows that the disease has spread widely and that the end is not far off.

Cancer of the womb is very rare before the age of thirty, and after then may occur at any time, but is most frequent between the ages of forty and fifty, that is, about the time of the " change of life." Now the earliest symptom is bleeding and discharge from the ulcerating growth on the cervix, and this will occur not at the regular monthly times but at irregular intervals—indeed, at any time, and quite independent of menstruation. If the chapter on the physiology of menstruation is studied, it will be seen that the menstrual discharge comes from the lining of the body of the uterus. The discharge in cancer comes from the ulcerated cancerous growth of the cervix and has therefore no relation whatsoever to the menstrual periods. It is most likely to be provoked by rubbing or touching the ulcerated surface. Hence bleeding is common after a vaginal examination or after a douche. Active exercise, a hard day at the wash-tub or sewing-machine, by causing movement of the vaginal walls over the growth, is likely to produce hæmorrhage. Bleeding after sexual connection is often the first symptom noticed. Very often these irregular bleedings are put down to " the change " and no attention is paid to them. The midwife must remember that this is the time of life when cancer most frequently occurs, and advise her patient to be examined ; she may thus be the means of the disease being treated at an early and favourable stage.

The discharge is generally thin and watery and often slightly blood-stained. At first it is not usually offensive, but becomes so later on. A foul-smelling discharge is often a sign of advanced disease, and when present should always lead to a full examination by a medical practitioner.

Hæmorrhage from the vagina after the " change of life " is nearly always due to cancer, and, therefore (to quote from the C.M.B. Rules), " any discharge, either

red or offensive, in a woman in whom the monthly periods have ceased for some time, should be attended to at once." The midwife must remember that the " change of life " when it occurs naturally should not be accompanied by irregular losses, and that she ought never to express any opinion in such cases, but advise the woman to seek a medical examination, because the case may be one of early cancer.

Cancer of the Breast begins as a small hard lump or nodule which gradually increases in size, finally reaching the skin and ulcerating into a sore. Whilst it is small and movable in the breast it may be removed by a surgical operation with almost a certainty of complete cure. When it has grown into the skin above, or the muscle underneath the breast, and has become fixed, its seeds are probably widely spread and return of the growth is likely ; once it has ulcerated through the skin and the glands in the axilla are enlarged, the time has usually passed when any surgical operation will serve to eradicate the disease. At first there is no pain, so the all-important matter is that the midwife should urge any woman who may tell her or consult her about it, or in whom by chance she may discover, a lump in the breast, to seek medical advice at once. The C.M.B. leaflet says : " All women who discover a lump in the breast should at once see a surgeon who is in the habit of dealing with such lumps."

The usual practice nowadays is for all nodules in the breast to be removed and examined microscopically to verify their nature. If they are not malignant, the operation has been a trifling one and all doubt is cleared up ; if they are cancerous, then the whole breast is removed. In this way error and the delay and chance of spread, which watching the rate of growth and waiting for other signs of cancer involve, are avoided.

CHAPTER XXXIV.

MATERNAL AND INFANTILE MORTALITY.

At present so much attention is given to maternal and infantile mortality that it is necessary for the midwife to have some idea as to what is the meaning of these terms and what information can be obtained from the figures issued by the Registrar-General (after this R.G. for short).

Though the R.G.'s returns, giving the deaths of mothers in child-bearing as certified by the medical practitioners in attendance, are approximately correct, the amount of maternal disability and inefficiency can only be surmised. The damaged are a very much larger proportion of the total casualties than the deaths, but the latter must be taken as the only available statistics for purposes of comparison between one area of the country and another, or between one year or term of years and another, and thus for obtaining a rough idea of the working of the maternity service and where it calls for improvement.

The amount of disability can only be gauged from the large proportion of attendances at gynæcological hospitals due to the effects of child-bearing. It will be justifiable, however, to consider that where and when the mortality is high, so is the disability, and that a lowering of the mortality rate will mean also a lowering of the disability rate, though possibly not to an equivalent degree.

In discussing this aspect of midwifery, the plan will be adopted of considering first, what can be learnt from the official mortality returns, mentioning the commoner causes of the mortality and disability which it is the object of midwifery to lessen and, finally, of indicating some directions in which modification of the Maternity Service is called for.

By international agreement the statistics in child-bearing show the *maternal mortality for every* 1000 *live births*, and it is essential that the meaning of the official figures should be clearly understood. What they show is the price the nation pays in deaths of women registered as due to child-bearing in any one year for every 1000 live-born infants whose birth is registered in that year. It is important to bear in mind that on one side are counted the deaths of the women who die as a result of abortion, ectopic pregnancy, and the various manifestations of the toxæmia and other diseases of pregnancy as well as in child-birth itself, whilst on the other side those labours are not counted that result in dead-born children, so that the maternal deaths are not those resulting from 1000 labours. The mortality rate of maternity charities reckoned on the number of deliveries is, therefore, not strictly comparable with the maternal mortality rate as given by the R.G.

In England and Wales, little change occurred from the establishment of registration up to the beginning of this century when an improvement occurred for the first ten years, followed by a relapse or stationary stage that reverted to the figures of the early years of the century. Whilst the infant mortality has been reduced to less than half during this century and the general death-rate by about a third, the death-rate in child-bearing has shown but a trifling diminution. In England and Wales the rate is about 4 maternal deaths for every 1000 births registered, or one mother for every 250 live children born.

The comparison frequently made between the maternal and infantile mortality rates is not a fair one, because the problem in the two cases is very different. The infantile rate was extremely high, over 150 infants out of every 1000 dying before completing their first year of life, so that there was room for a great reduction. Also the problem was a much simpler one in that for a reduction in the mortality hygienic measures were chiefly called for, its causes being chiefly bad feeding, with

resulting gastro-intestinal (diarrhœa and vomiting) and respiratory (bronchitis and pneumonia) infections. On the other hand, the causes of the maternal death are much more complex and little affected by hygiene. Throughout the biological world nature exacts a certain toll from the old stock in producing the new, and a much heavier toll from the new stock in its immature stages. The latter, however, is greatly lessened among domestic animals, for instance, when the young stock is cared for by being sheltered from the struggle for existence, and not open to be preyed on. Though physiological, reproduction is a time of stress that discovers the weaklings, and particularly those damaged by disease that survive in conditions of our civilization, but would not in a state of nature. The underlying cause of many factors in the mortality is unknown, and prevention therefore difficult, and the more serious complications occur so occasionally that experience in their management is only possible to those with exceptional opportunities.

When the causes of this death-rate come to be examined, it is found that the largest factor is that of puerperal sepsis, which accounts for over a third of the whole (about 1·5 per 1000 registered births). Next come the toxæmias of pregnancy (albuminuria, eclampsia) and then the hæmorrhages, which together account for nearly another third, and the rest are due to difficult and complicated labours, embolism, and sudden death, and other accidents in child-bearing.

The variations in the rate throughout England and Wales are also noteworthy as showing where progress is particularly called for. Wales has a higher rate than England, and the North of England a higher than the South. The highest rates occur in sparsely populated rural areas ; in the highly industrialized areas, specially the textile towns of Lancashire and Yorkshire, and in the mining areas. It is lowest in London and the large centres and county boroughs. It may be argued from these figures that in London and the big centres, like Liverpool, Manchester, and Birmingham, the mortality is lower, because medical aid is readily obtained and hospitals and other facilities are available for the treatment of difficult and complicated cases, and is higher in the rural districts and small towns where there is little provision of the kind. This view is supported by the high rate in thinly populated and mountainous areas like Westmoreland and Cumberland and parts of Wales where communications are difficult, but there remains the difficult problem of explaining why in certain thickly populated industrial areas the maternal mortality is higher than in London and the big cities. Evidence has been brought forward to show that the puerperal-fever-rate varies directly with the incidence rate of industrial accidents in the main industry of the area, and that the prevalence of puerperal sepsis is dependent on the frequency of infected wounds in the population and the conveyance of infection from them. The problem is a difficult one, however, owing to the multitude of factors present, and it is questionable if so simple an explanation will suffice.

Another remarkable point is, that the incidence of puerperal infection does not appear to bear any relation to housing conditions, and it is not in the slum areas and among the lowest, dirtiest, and worst-housed districts that it is highest. In London, for instance, Shoreditch and Southwark have a lower rate than Hampstead. It is difficult to understand why insanitary surroundings should have so little influence on the incidence of puerperal fever. Perhaps the fact that a much greater proportion of these women deliver themselves, and that there is much less internal interference than in the case of the better-housed but less normally delivered women, may partly explain this anomaly. The suggestion is made, also a purely hypothetical one, that those living and surviving in insanitary conditions have acquired a greater immunity.

Besides being a big factor in the death-rate, the infections play a large part in causing disability, as all intoxications have a serious effect on body and mind from which it may be long before recovery is complete, and chronic infections of the cervix and body of the uterus, of the Fallopian tubes and pelvic tissues, may remain, causing sterility and invalidity.

The mother is the executive in the rearing of the family, and if the effect of the loss of maternal care on the rising generation is borne in mind, the vast importance to a nation of the reduction of maternal mortality and incapacity will be seen in its due perspective. It is not only that women at an early age and at the height of their

powers are killed or injured, but also that their young families lose entirely or are denied their just share of the watchful care that only a mother can give.

A rate of 4 per 1000 live births may not appear large, but when that proportion is multiplied by about 700,000 live births in England and Wales in each year, it will be seen that it represents about 2800 deaths of women in the prime of life during a natural function, and of them a large percentage, possibly 75 per cent., are preventable. It is these considerations that justify the agitation about the persistent maternal mortality and not that this country is behind hand in its midwifery work.

The *infant mortality rate* is similarly calculated on the number of infants under 12 months of age that die in any one year for every 1000 live births registered in that year. That is, it shows the wastage that occurs in the first year after birth. The rate at the end of the last century was 154 out of every 1000 live-born children, by 1922 it was half that, *i.e.* 77, and since has been below 70 per 1000.

The infant mortality is highest in the county boroughs, especially in the North of England, and lowest in country districts. It is highest among the casual labour class and lowest among the middle and upper classes, and, unlike the maternal mortality, is highest in the crowded areas and where housing conditions are bad. It is also affected by other social conditions, *e.g.* the mortality among illegitimate children is double that of the legitimate.

Infant mortality is highest in the first three months of life, and the great reduction that has occurred during this century has scarcely affected this early mortality. It is due chiefly to prematurity, birth injuries, toxic conditions of the mothers and errors of development in the fœtus, and is, therefore, due to causes falling into the sphere of midwifery. Too little is known of the causes of developmental errors for anything to be done to affect the small proportion of neonatal deaths from them. The prevalence of the other causes may be lessened by careful antenatal supervision ; syphilis in the mother is curable, and if detected and treated early in the pregnancy the child will not be affected ; toxæmia of pregnancy usually yields to treatment in its early stages, and so with other maternal conditions that are both a cause of prematurity and the birth of infants with a poor hold on life. The prevention of complications in labour and good management of labour will lessen birth injuries. In this way good midwifery may help to lower the infantile death-rate.

Still-births are due to the same causes as given above for early death after birth and are mentioned on p. 284. They are equivalent to about 3 per cent. of the live births. It is reckoned that more than half of them are preventable by antenatal supervision and perhaps more especially by care during the labour itself.

These figures, then, both from the R.G. and from the returns in cities and counties are of value in showing where there is progress and where there is need of improvement. They also allow of comparison of one year with another, or what is more accurate of five-yearly averages, so that it is possible to know if mortality is increasing or diminishing. Finally, the figures allow of a comparison with those of other countries, so far as the system of registration and variations in their application will allow.

Roughly this country occupies internationally a good intermediate position. The Scandinavian countries (*e.g.* Sweden, Denmark) and Holland, have a lower rate, with Italy but little behind, and then come the main European countries with a rate that is somewhat above ours, while the United States, where registration is defective, appears to have a higher rate still, as do most of our overseas Dominions.

However, these comparisons are not as useful as those in our own country where the registration system varies little, though Scotland, which has a higher rate than England and Wales, has differences in registration that appear to explain some part at any rate of their increased mortality. The rates, however, which appear to show the lowest mortality are not from official returns, and are not calculated on the same basis are those unofficially issued by hospitals and other institutions and charities and by the Queen's Institute—the largest employer of midwives in the country when all the County Nursing Associations affiliated to it are included. Here also the cases being partly a selected group, deaths in pregnancy not being included, and the method of reckoning being per 1000 confinements as against per 1000 live births, make accurate comparison impossible. It is, however, clear that even making allowances for all these factors, the best results in this country are obtained under the

system worked by institutions. The system may be described shortly as careful antenatal supervision of all patients, those with anticipated or suspected complications being taken into hospital, and those without indication of abnormality being attended on the district by midwives with the house surgeon first on call and the hospital available should unforeseen difficulties arise, and an obstetric specialist for the serious cases. This system, together with the highly-trained and experienced personnel, both in medical practitioners and midwives, and the careful supervision and investigation of all cases, results in the loss of mothers being reduced to about half that of the figures in the country as a whole.[1]

There are now schemes for a National Maternity Service, based on similar lines to the institutional practice, in which every woman will be able to have the services of a medical practitioner for one or more antenatal examinations, so as to determine that the case presents no complications calling for hospital treatment or condition that would make it advisable for the confinement to take place in hospital. The attendance on cases expected to be normal would be kept by the midwife with the doctor responsible for the antenatal work on call in case medical aid was required by the midwife. Similarly the services of an obstetric specialist would be obtained by the doctor in the event of unexpected complication in labour or lying-in or ambulance transport and a bed in hospital should that appear the preferable course to take. The proposed schemes are to be financed on an insurance basis similar to that of the National Insurance.

When these schemes become translated into an Act of Parliament, the position of the midwife in them will be a very important one and, therefore, her training and fitness for the work will be even more than in the past a matter of national concern. For this reason there are certain to be as great changes in the training and practice of midwives as those that have occurred since the first Midwives' Act came into being. Both for the sake of patients and for training, it will be advisable to form large maternity hospitals, rather than numbers of small ones. Besides being equipped to deal with the more serious cases for a wide area, now made so much easier by motor ambulance transport, those large centres would play the same part as the hospital does in institutional practices and allow of the acquirement by the doctors of special experience which would become available for consultations throughout that area ; it would also be a school both for pupil midwives and for refresher courses for practising midwives and generally be a focal point for midwifery practice and training. The smaller type of maternity home or cottage hospital could be used to serve as a lying-in home for normal cases whose home conditions were unsuitable or the woman wished her confinement to take place away from her home.

In playing her part in helping to reduce maternal mortality and disability, the midwife should be inspired with the idea that her part is the all-important one of securing normal function throughout the process of reproduction, and that it is by working to this end that she will be most likely to succeed. She will begin in pregnancy by assisting the doctor in preserving the health of body and mind of her patients and watching for the first signs of disorder of any kind, so that it may be remedied at once and, if possible, before harm has resulted. Except for the cases in which complications are feared, the management of labour will fall to her, and, again, the same idea must be first in her mind—to preserve normal function throughout labour, and to eliminate any causes of its disturbance, to detect abnormality early, and obtain medical aid. Her success will be estimated by the proportion of normal cases obtained with recovery of the mother without disability and able to nurse and rear a healthy infant.

[1] The figures from the General Lying-in Hospital indicate the results obtainable under this system. In the ten years (1919–28), 9680 in-patients were delivered with 39 deaths, and 16,518 out-patients with 3 deaths, making a total of 26,198 with 42 deaths, a rate of 1·6 per 1000 deliveries. If this rate is increased by 12 per cent. to allow for pregnancy deaths, stillbirths and twin-births, a rate comparable with the R.G.'s is obtained and is less than half that for the country as a whole.

APPENDIX.

I.

SCHEME OF NOTE-TAKING DURING LABOUR.

The following scheme, drawn up for the guidance of the writer's midwifery pupils, will be found useful in training the pupil to adopt a thorough and systematic method of examining, observing, and recording her cases.

The notes need not be made at one time. The history and general observation of the patient may be made at the time when the arrangements for the confinement are made. Indeed, that is the best time for the preliminary examination, as it may serve to detect abnormalities or at any rate to warn the attendant. The examination of the patient at the time labour commences would follow, then the observation of the labour throughout its various stages, followed by notes on the condition of the mother and child at its termination. The observation will be continued throughout the lying-in time, and will end with a record of the state of mother and infant on giving up attendance.

In a normal case a number of the suggested points will be negative and will require no mention, but the pupil should acquire the habit of investigating them all so as not to overlook them when the abnormal does turn up, as sooner or later it must do.

For the practising midwife the scheme will suggest a method of keeping a fuller record of her complicated cases than is possible in the register in which she must record all her cases in accordance with the regulations of the C.M.B.

If she wishes to keep records for easy reference a selection of headings may be made on a card—say, half as big again as, or double the size of, the ordinary post-card—so that by using both sides and employing abbreviations a fairly complete record can be obtained in a small space. These cards can then be arranged in the alphabetical order of the names, and if filed or kept in a proper card-index drawer can be referred to in a moment. As an example of the use of abbreviations, the following letters and figures after the name of the patient—$Pr._6$, $M._2$, $C._4$, $L._2$, $St.b._1$, $D._1$—would mean that she had had 6 pregnancies, of which 2 had ended in miscarriage, had had 4 children, of which 2 were living, 1 was stillborn, and 1 was dead. Other similar abbreviations will occur to each individual, and so long as they are easily understood and not confused will serve to give valuable information in small space. Should the midwife have to undertake antenatal care, welfare, or social work, one side of the card may be devoted to it, and headings selected from those mentioned in Chapter VII. made to suit the character of her work and practice, such as for the social conditions of her patients, the preparations made for the confinement, the centres or social organizations in touch with the patient, and so on. If the midwife is to make the position for herself it is hoped she will, it is essential that she should have accurate information about her patients and her work upon which she can readily lay her hand.

DIRECTIONS FOR NOTE-TAKING.

Name, Address, Age of Patient. Date of Expected Confinement.

Past History.—Number of previous labours and miscarriages with date of first and last labours.

Note any complications in the pregnancies, labours, or puerperia.

History of Present Pregnancy.—Date of last appearance of menses and time of quickening.

Note any troubles during pregnancy which might lead to evidence of placenta prævia, kidney disease, etc. (such as hæmorrhage; urine—quantity, frequency, and appearance; headache; sickness; swelling of legs or face; insomnia). Many of these particulars will have been noted on the antenatal card. They may be replaced by the antenatal card or an abstract of it.

Time of arrival at case; conditions of house and surroundings.

Present Labour.—When pains began; frequency and strength.

Ask if a "show" has been noticed and if the membranes have ruptured.

Notes when the bowels last acted.

Examination.—Note if the patient is well formed, or if any sign of rickets or other deformity is present. General condition: stoutness, emaciation, pallor, blueness, breathlessness; also any puffiness of face, hands, legs; varicose veins, etc.

Note pulse and respiration rate, temperature.

Inspection.—Of Abdomen: Size, shape, pendulous belly, or any unusual appearance; distended bladder.

(External measurements by pelvimeter if not noted on antenatal card.)

Palpation.—Of Abdomen: Height of fundus uteri; position of fœtal parts. Pelvic examination, mid-abdominal examination, fundal examination, etc.

Auscultation.—Fœtal Heart: Position of maximum intensity and rate.

Vaginal Inspection.—Note any large veins, ulceration or swelling of the vulva; condition of perineum; hæmorrhage or unusual discharge.

Vaginal Examination.—Note if cervix is present or if the canal is taken up: the size of the os: whether the membranes have ruptured or not: presenting part; if high or low in pelvis. If the promontory can be felt, measurement of diagonal conjugate should be made and the length of the true conjugate deduced from this.

1. **Vertex Presentation.**—If there is a large caput; position of sutures and fontanelles, good flexion (shown by the anterior fontanelle being high up and the posterior low down).
2. **Face Presentation.**—Chin to the front or back; good extension (shown by chin being low down.)
3. **Breech Presentation.**—Position of fœtal sacrum, whether the feet can be felt, or whether the breech descends with the pains.
4. Any unusual presentation or prolapse of an arm or the cord, placenta prævia, etc.

OBSERVATIONS DURING THE COURSE OF LABOUR.

First stage.—Note at intervals the character, frequency, and duration of the pains; time of rupture of the membranes and size of os; time of full dilatation and thus duration of the first stage.

Second stage.—Repeat observations on the pains; watch rate of descent of the presenting part; note fœtal heart rate; size of caput; describe birth of the child; make note of pulse at intervals; duration of second stage.

Third stage.—Condition of the uterus; height; description (*e.g.* after ten minutes the uterus became harder, smaller, more movable, and rose in the abdomen, *i.e.* signs of expulsion of placenta into vagina). Note if placenta is expelled by patient's own efforts or is expressed by attendant. Estimate total amount of hæmorrhage of third stage; duration of third stage.

Note if any tears of perineum, vulva, etc.

Note pulse, temperature, and general condition of mother, and state height of uterus and if well contracted.

Note if placenta and membranes were complete when examined; mode of insertion of cord, its length, or any unusual appearance of placenta, etc.

Child.—Sex, length, weight, measurements of head; vigour; breathing; treatment of eyes.

Note if any malformation or signs of prematurity.

OBSERVATIONS DURING PUERPERIUM.

Mother.—At each visit note—General condition; sleep; appetite; bowels; urine; after-pains; skin (hot, dry, moist); pulse; respiration; lochia (profuse, clots, colour, odour, etc.); height, hardness, tenderness, etc., of uterus; breast and nipples.

Note day of commencement of lactation; aperients and result, and any unusual condition in patient.

Child.—At each visit note—Appearance and general condition; sleep; sickness; fretfulness; number and character of stools; urine; state of eyes, mouth, skin, etc.; cord; how food is taken, especially if not breast-fed. Any unusual swellings of head, body, etc.

Note occasionally—weight and whether appears thriving.

Note date of separation of cord and condition of navel.

At last visit make full note as to condition of mother and child and any special instructions given to the mother.

II.

WEIGHTS AND MEASURES.

The cumbersome system of the British Pharmacopœia is still in general use for the weighing and measuring of drugs and lotions. The metrical equivalents are given in brackets.

The weights with their signs are:

1 grain	=gr. i.	[=65 mgms.]
60 grains	=1 drachm (ʒi).	[=3·9 grms.]
437½ grains	=1 ounce (℥i).	[=28·35 grms.]
16 ounces	=1 pound (lb.i).	[=453·6 grms.]

The measures with their signs and rough domestic equivalents are :

1 minim	= ♏i.	[=·059 c.c.]
60 minims	=1 (fluid) drachm (ℨi).	[=3½ c.c.]
8 drachms	=1 (fluid) ounce (℥i).	[=28·42 c.c.]
20 ounces	=1 pint (Oi).	[=568⅛ c.c.]
8 pints	=1 gallon (Ci).	[=4½ litres.]

(2 pints=1 quart ; 4 quarts=1 gallon.)
A minim is roughly 1 drop.
A drachm is roughly a teaspoonful.
2 drachms are roughly a dessertspoonful.
1 ounce is roughly 2 tablespoonfuls.
A breakfast cup contains about 8 and a tumbler 10 to 12 ounces.

The domestic equivalents are, however, so rough that they ought never to be used when a measure glass is available.

From a study of these tables the method of making up of lotions for use in the labour room will be easily deduced. To prepare a 1 in 20 carbolic acid lotion, 1 ounce of liquid carbolic acid is taken, and water to make 1 pint added and the whole thoroughly mixed.

The strength of lysol solution made by the addition of a teaspoonful of lysol to a pint or quart can be readily calculated. A teaspoonful is roughly one drachm ; as 8 drachms go to the ounce and 20 ounces to the pint, a teaspoonful of lysol in a pint is roughly 1 in 160 (161 to be exact) and in a quart 1 in 320 (or more accurately in 321).

The Metric System, which, unfortunately, is not in general use, is much to be preferred. The unit of weight is 1 gramme, which is the weight of 1 cubic centimetre of water.

A litre is 1000 cubic centimetres (or about a pint and three-quarters).

The gramme (which is nearly 15½ grains) is subdivided into tenths (decigrams), hundredths (centigrams), and thousandths (milligrams) ; 1000 grammes makes 1 kilogram (roughly 2¼ lb.).

The advantage of the Metric System is its extreme simplicity, especially the ease by which the measures can be converted into weights—a litre of water weighs 1 kilogram.

To make a 1 in 1000 solution, 1 gramme is dissolved in 1000 cubic centimetres, *i.e.* 1 litre of water. To make the same strength in the British system, 8¾ grains must be added to a pint of water, and many complicated calculations are necessary in working with it, for there is no simple connection between weight and measure.

The following approximate equivalents of the Metric System may be useful :

LENGTH . . .	1 metre	=39⅓ inches.
	1 centimetre (cm.)	= ⅖ inch.
	1 millimetre (mm.)	= $\frac{1}{25}$ inch.
	1 inch	= 2½ cms.
WEIGHT . . .	1 gramme (grm.)	=15·4 grains.
	1 kilogram (kilo.)	=2 lb. 3¼ oz.
	1 centigram (cgm.)	= ⅙ grain.
	1 milligram (mgm.)	= $\frac{1}{65}$ grain.
VOLUME . . .	1 litre (l.)	=35 fl. oz.
	1 c.c.	=17 minims.

The British thermometer scale is as archaic as the weights and measures. The freezing-point is 32°, and the boiling-point 212°. In the simpler Centigrade thermometer the freezing-point is 0°, and the boiling-point 100°. Equivalent temperatures on a chart would be :

98·4° F.=36·9° C.	102° F.=38·9° C.
99° F.=37·2° C.	102·5° F.=39·2° C.
99·5° F.=37·5° C.	103° F.=39·4° C.
100° F.=37·8° C.	103·5° F.=39·7° C.
100·5° F.=38·1° C.	104° F.=40° C.
101° F.=38·3° C.	104·5° F.=40·3° C.
101·5° F.=38·6° C.	105° F.=40·6° C.

GLOSSARY OF TERMS NOT EXPLAINED IN TEXT.

ABDOMINAL SECTION.—An operation in which the abdomen is opened, *i.e.* the abdominal wall is cut through and the peritoneal cavity opened. *See* Cœliotomy, Laparotomy.

AMNESIA.—Loss of or abolition of memory (p. 317).

ANÆMIA.—Poorness of the blood or deficiency of blood.

ANÆMIC.—The adjective of anæmia. A patient is *anæmic* when suffering from poorness or loss of blood; a part of the body is *anæmic* when its blood supply is deficient.

ANALGESIA.—Loss of or abolition of pain.

ANASARCA.—Dropsy or œdema.

ANKYLOSIS.—Stiffening or immobility of joints; *e.g.* an *ankylosed* hip is an immovable hip-joint, —generally the result of disease.

ANOREXIA.—Loss of appetite.

ARTICULAR.—Relating to a joint; *e.g. articular rheumatism*, rheumatism in the joints.

ARTICULATION.—A joint.

ASCITES.—Fluid in the abdomen; dropsy of the peritoneal cavity.

ASTRINGENT.—Having the power of drying up; *e.g.* an *astringent injection* is one used to diminish excessive discharge.

ATROPHY.—Wasting or withering up; means strictly not properly nourished; *e.g.* muscles undergo *atrophy* or become *atrophic* from want of use; the breasts and the female genital organs atrophy after the change of life.

AXILLA.—The armpit.

BALLOTTEMENT.—Means literally tossing. Used of the examination of the pregnant uterus for the first signs of the fœtus when it can be tossed about by the fingers (p. 73).

BASIOTRIBE.—An instrument for crushing the base of the fœtal skull to effect delivery when there is not room for the uncrushed skull to pass.

BASIOTRIPSY.—The operation of crushing the skull with a basiotribe.

BORBORYGMUS.—The gurgling or rumbling sound caused by the movement of gases and fluids in the bowels. Plural, borborygmi.

BOUGIE.—An instrument like a catheter without an eye and without any channel. Used in bringing on labour (p. 315).

CALCAREOUS.—Impregnated with lime salts. Gritty areas in the placenta may be due to this. *See also* Lithopædion.

CALCULUS.—A stone such as those formed in the kidney, bladder, or gall bladder.

CANCER.—A malignant growth. It is composed of epithelial elements, the cells of which eat into other tissues and seed themselves throughout the body, forming similar growths in distant parts. The growths tend to ulcerate when they reach the surface.

CARCINOMA.—Cancer.

CARIES.—Decay of the bones or teeth; *e.g. caries* of the spine. Usually caused by tuberculous, pyogenic, or syphilitic infections.

CATHARTIC.—Purging; *e.g.* a cathartic drug is one that causes purging of the bowels.

CEPHALOTRIBE.—An instrument for crushing the fœtal skull to effect delivery when there is not room for the uncrushed skull to pass.

CEPHALOTRIPSY.—The operation of crushing the skull with a cephalotribe (p. 310).

CHLOASMA.—Patches of brownish pigment on the skin, frequently on the forehead; *e.g. chloasma gravidarum*—patches of pigment occurring in pregnancy.

CICATRICIAL.—Relating to a scar; *e.g.* cicatricial tissue=scar tissue.

CŒLIOTOMY.—Abdominal section.

COLPEURYNTER.—A bag to dilate the vagina.

COLPEURYSIS.—The operation of dilating the vagina by a bag.

COLPORRHAPHY.—Operation for repair or narrowing of the vaginal outlet, generally rendered necessary by laceration or overstretching during difficult labour.

COMA.—Stupor; a state of unconsciousness. Occurs in eclampsia (p. 224), apoplexy, in extreme drunkenness, etc.

COMATOSE.—In a stuporous or unconscious state. The adjective to describe a condition of coma.

CONGENITAL.—Existing from birth; *e.g.* a congenital deformity is one present when the child is born.

CONGESTION.—Increased flow of blood to, or accumulation of blood in, a part of the body. *See also* Hyperæmia.

CRANIOCLASM.—The operation of breaking up the skull with a cranioclast (p. 310).

CRANIOCLAST.—An instrument for breaking up the fœtal skull to effect delivery when there is not room for the unbroken skull to pass.

CURETTE.—A sharp spoon-like instrument used for scraping the interior of the uterus.

CURETTING.—The operation of scraping the uterus.

CUTANEOUS.—Pertaining to the skin; *e.g.* cutaneous eruption=an eruption or spots on the skin.

CYANOSED or CYANOTIC.—The adjective to describe the condition of cyanosis.

CYANOSIS.—Blueness of the surface of the body, due to want of oxygen in the blood (p. 11).

CYSTOCELE.—Prolapse of the anterior vaginal wall and bladder, causing a protrusion at the vulva: generally the result of overstretching of the outlet at labour.

CYSTOSCOPE.—An instrument for examining the interior of the bladder.

DEBILITY.—Loss of power; weakness.

DÉBRIS.—Remains; fragments.

DECOMPOSITION.—Putrefaction. Really the breaking up of complex substances into their simpler component parts.

DEFÆCATION.—The act of emptying the bowels.

DELIRIUM.—Wandering of the mind, with restlessness, excitement, and sometimes delusions.

DERMOID.—A cyst containing skin and hair, with fatty secretion from the skin and other structures. Common in the ovary, when it may form an obstruction to delivery.

DIAGNOSIS.—The distinguishing of one disease or condition from another by the examination of the patient.
DIAPHORESIS.—Profuse sweating.
DIAPHORETIC.—Producing sweating; *e.g.* *diaphoretic drugs* cause sweating.
DIURESIS.—Increased secretion of urine.
DIURETIC.—A drug used to increase the flow of urine.
DORSAL.—Pertaining to the back.
DYSPAREUNIA.—Painful sexual connection.
DYSPEPSIA.—Impaired digestion.
DYSPEPTIC.—Affected with dyspepsia.
DYSPNŒA.—Difficult or laboured breathing.
DYSTOCIA.—Difficult labour.
DYSURIA.—Difficult or painful micturition.

ECBOLIC.—Producing abortion or labour. Often applied to drugs given for such purposes.
ECCHYMOSIS.—Effusion of blood under the skin or mucous membrane; *e.g.* a bruise.
ECTOPIC GESTATION.—Pregnancy outside the usual place, *i.e.* the normal uterine cavity. This is a wider term than extrauterine gestation (p. 92), as it includes pregnancy in an abnormal part of the uterus—a rudimentary horn or in the uterine portion of the Fallopian tube.
ECZEMA.—An irritating inflammation of the skin, generally accompanied by weeping of the surface. Not contagious.
ECZEMATOUS.—Affected with eczema.
EMESIS.—Vomiting.
EMETIC.—A drug or other agent which causes vomiting.
EMPHYSEMA.—Distension of the tissues with air or other gases. If of the lungs (=pulmonary emphysema) it is a disease characterized by dilatation of the air cells.
EMPYEMA.—Pus in the pleural cavity.
EMULSION.—A milky fluid containing fatty or oily matter as minute globules suspended in it.
ENTERIC.—Pertaining to the intestines.
ENTERIC FEVER.—Typhoid fever.
ENTERITIS.—Inflammation of the intestines.
EPIGASTRIC.—Pertaining to the region of the epigastrium; *e.g.* epigastric pain=pain in the epigastrium.
EPIGASTRIUM.—The region over the stomach.
EPIPHYSIS.—The growing end of the bone, which becomes united with the rest of the bone when growth is completed. In babies the epiphysis may be separated from the rest of the bone by injury.
EPISIOTOMY.—An incision of the perineum to prevent laceration; sometimes done when laceration appears inevitable, to substitute a clean cut for a ragged tear.
EPITHELIAL.—Pertaining to epithelium (the adjective).
EPITHELIUM.—The layer of cells covering the surface of the body and lining the internal organs and passages.
ERYSIPELAS.—An acute septic infection of the skin and mucous membranes. Caused by a streptococcus; contagious, and characterized by spreading redness and swelling with high fever.
ERYTHEMA.—Redness of the skin, due to dilatation of the arteries. Hence pressure with the finger causes it to disappear, but it returns when the pressure is withdrawn.
EXACERBATION.—Increase in the severity of a disease.
EXCRETE.—To throw off waste material, *e.g.* by urine, fæces, etc.
EXCRETION.—The process of excreting, also the matter excreted.
EXOMPHALOS.—Protrusion of the umbilicus; generally a hernia of some of the abdominal contents—*i.e.* umbilical hernia (p. 290).
EXOSTOSIS.—A bony growth, *e.g.* those from the pelvis, which may form a very rare obstruction to delivery (p. 193).
EXTRAUTERINE.—Outside the uterus.
EXTRAUTERINE PREGNANCY.—Pregnancy in the Fallopian tube or other structure not uterine. *See* Ectopic for slight difference in meaning.

FÆCAL.—Pertaining to the motions.
FÆCAL MATTER.—Matter containing fæces.
FÆCES.—The motions, the matter excreted from the bowel (p. 16).
FAUCES.—The back part of the mouth and beginning of the throat.
FECUNDATION.—The fertilization of the ovum by the spermatozoon (p. 55). A term of similar meaning is Impregnation.
FENESTRATED.—Having an opening like a window; *e.g.* the blades of the midwifery forceps (p. 305).
FIBROID, FIBROMYOMA.—Tumours of the womb.
FISTULA.—An abnormal passage; *e.g.* a fæcal fistula is one from the bowels to the surface of the body through which fæcal matter discharges.
FOLLICLE.—A small secretory sac or gland.
FORAMEN.—An opening, commonly through bone, but also used for openings in the heart, brain, etc.; plural, foramina.
FORNIX.—An arch; plural, fornices. The vaginal fornices are the vaulted upper portions of the vagina.
FRENUM.—Literally a bridle: the small band below the tongue, on the foreskin and elsewhere, holding down the part to which it is attached.
FRIABLE.—Brittle, so that it breaks up easily.
FUNDUS.—The enlarged rounded end of an organ; *e.g.* fundus uteri (pp. 40, 41).
FUNIS.—The umbilical cord.

GALACTOGOGUE.—A substance having the power of increasing the flow of milk.
GALACTORRHŒA.—A running away or excessive flow of milk.
GANGLION.—Generally a mass of nerve-cells forming a slight enlargement on a nerve. Plural, Ganglia.
GANGRENE.—The mortification or death of the tissues of the body.
GASTRIC.—Pertaining to the stomach.
GAVAGE.—Feeding by stomach-tube. This term is often used for the feeding of premature babies by a soft rubber catheter passed down the œsophagus (p. 282).
GERMICIDAL.—Capable of killing germs (p. 133).
GERMICIDE.—An agent capable of killing germs (p. 138).
GESTATION.—Pregnancy.
GLAND.—An organ which separates material from the blood. Most glands have a duct by which the secretion is discharged, but some glands are ductless and are supposed to have an internal secretion. The lymphatic glands modify the blood.
GRAVID.—Pregnant.
GRAVIDA.—A pregnant woman.
GRAVIDITY.—Pregnancy.
GYNÆCOLOGY.—That branch of medicine which deals with the diseases of the female pelvic organs.

HÆMATOCELE.—A tumour of blood: a hæmatocele in the pelvis frequently results from an extrauterine pregnancy (p. 92).
HÆMATOCOLPOS.—Blood retained in the vagina; generally the result of retained menstrual blood from imperforate vagina (p. 52).

HÆMATOMA.—A collection of blood in the tissues.
HÆMATOSALPINX.—Distension of the Fallopian tube with blood.
HÆMORRHOIDS.—Piles; dilated and varicose veins of the rectum (p. 68).
HALLUCINATIONS.—Delusions of seeing or hearing things.
HEBOSTEOTOMY.—Pubiotomy (p. 312).
HERNIA.—Rupture; the protrusion of a part of the body through an abnormal opening.
HYDATIDIFORM.—Like a hydatid, which is the cyst stage of a parasitic worm—one name of cystic mole (p. 92).
HYDRARGYRI PERCHLORIDUM. — Perchloride of mercury, corrosive sublimate.
HYDRARGYRUM.—Mercury, quicksilver.
HYDROSALPINX.—Distension of the Fallopian tube with watery fluid; generally the result of closure of the fimbriated opening of old inflammation (p. 242).
HYPERÆMIA.—Excess of blood in a part—much the same as congestion.
HYPERÆMIC.—The opposite of *anæmic*; it is the adjective to describe the condition of *hyperæmia*.
HYPERÆSTHESIA.—Excessive sensitiveness.
HYPEREMESIS.—Excessive vomiting.
HYPERPYREXIA.—Excessively high fever (p. 21).
HYPERTROPHY.—Normal or abnormal increase in the size of an organ or part of the body. The opposite of atrophy.
HYPNOTIC.—An agent, such as a drug, causing sleep.
HYPOCHONDRIUM.—The region of the abdomen below the ribs on each side of the epigastrium.
HYPODERMIC.—Subcutaneous; *e.g.* hypodermic injection—injection under the skin.
HYPOGASTRIUM.—The lower abdomen in the middle line—below the navel; the supra-pubic region.
HYSTERECTOMY.—The operation of the removal of the womb.
HYSTERIA.—Disturbance of the nervous functions of the body without evidence of disease, resulting in loss of control of emotions, sensations, or movements. Thought by the ancients to arise from disease of the womb, and hence the name.
HYSTEROPEXY.—The operation of fixing the womb.
HYSTEROTOMY.—The operation of cutting into the womb; *e.g.* Cæsarean section (p. 312).

ICTERUS.—Jaundice.
ILIAC.—Pertaining to the ilium (p. 31) or flank.
IMPREGNATION.—Making pregnant. *See* Fecundation and p. 55.
INANITION.—Wasting and exhaustion from lack of nourishment.
INCONTINENCE.—Inability to hold the evacuations of the bowel or bladder: *e.g.* incontinence of fæces—often the result of complete rupture of perineum; incontinence of urine—as in vesico-vaginal fistula.
INDURATED.—Hardened.
INDURATION.—Hardening of the tissues, as round an inflamed area.
INFARCT.—The hæmorrhagic or necrosed area of a wedge shape which is formed when the artery supplying it is blocked by a clot or other obstruction (embolus, pp. 19 and 247).
INFARCTION.—The production of an infarct by an embolus.
INGUINAL.—Pertaining to the groin.
INHIBIT.—The term commonly used by physiologists to mean check or interfere with.
INSOMNIA.—Sleeplessness.
INTERTRIGO.—The redness of the skin produced by chafing or contact of two skin surfaces, especially in moist parts, *e.g.* buttocks, vulva, groins, and armpits.
ISCHURIA.—Retention or suppression of urine.

JACTITATION.—Restlessness with throwing about of arms and legs; seen in delirium and extreme bloodlessness.
JAUNDICE.—Yellowness of the skin and whites of eyes due to bile pigment in the blood; the Latin word is Icterus.

KERATITIS.—Inflammation of the cornea. May occur in ophthalmia neonatorum.
KRAUROSIS.—Shrivelling and dryness of a part. Kraurosis of the vulva may occur after the menopause.
KYPHOSIS.—Humpback, angular curvature of the spine. Sometimes associated with pelvic deformity (p. 200, also Fig. 63).

LACTAGOGUE.—An agent used to produce secretion of milk.
LAPAROTOMY.—The operation of abdominal section, or cœliotomy.
LESION.—Damage to tissues from injury or disease.
LEUCODERMA.—Light patches on the skin due to absence of, or defective, pigmentation. Sometimes seen in connection with chloasma gravidarum.
LIGAMENT.—Band of tissue building parts together or supporting a part.
LITHOPÆDION.—A fœtus, almost always *ectopic*, which has been retained in the body so long that it has become calcified, *i.e.* of bony consistence, due to the deposit of lime salts.
LORDOSIS.—Curvature of the spine forwards—*i.e.* the opposite to kyphosis.

MACERATED.—Softened by long soaking in fluid. A dead fœtus will become macerated if retained in the liquor amnii, so that its skin becomes sodden and peels off readily.
MARASMUS.—Wasting or emaciation.
MELÆNA.—Tarry motions due to altered blood; black vomit from altered blood. May occur in the newborn.
MENINGITIS.—Inflammation of the membranes of the brain or spinal cord.
MENINGOCELE.—Protrusion of the membranes of the brain or spinal cord.
METRITIS.—Inflammation of the wall of the uterus.
MICTURITION.—The act of voiding urine.
MORBID.—Diseased.
MORBIDITY.—A diseased state. The term is in frequent use in regard to lying-in patients in giving the numbers or percentages of those who have had a disturbed or morbid puerperium. The standard of morbidity is generally taken as the same as that adopted by the C.M.B., and any case in which the temperature touches 100°·4 on two occasions is considered morbid.
MORIBUND.—Dying.
MUCOUS MEMBRANE.—Strictly the moist lining membrane of the cavities which communicate with the external air—as the bronchial and nasal cavities. Used more widely for the lining membranes of viscera and their ducts.
MYOMA.—A tumour containing muscular tissue, *e.g.* a uterine fibroid. A fibromyoma is for all practical purposes the same thing.
MYOMECTOMY.—The operation of removal of a uterine fibroid (myoma) without removal of the uterus.

NÆVUS.—Birth-mark. For the most part caused by dilated blood vessels. Sometimes due to pig-

mentation, though these would more strictly be termed "moles" (p. 247). Plural, nævi.

NARCOSIS.—Under the influence of a narcotic drug. Sometimes used as equivalent to anæsthesia.

NARCOTIC.—Producing sleep or insensibility. Opium, morphine, and chloroform are narcotic drugs.

NATES.—The buttocks.

NAUSEA.—Feeling of sickness; tendency to vomit.

NECROSIS.—Death of tissue. Used of a local or circumscribed destruction of tissue. Much the same meaning as "sloughing." The necrosed area is often described as a "slough." *See also* Gangrene.

NECROTIC.—Necrosed or dead.

NEONATAL.—Pertaining to the newborn.

NEONATORUM.—Of newborn infants; genitive plural of the next word.

NEONATUS.—A newborn infant.

NEPHRITIS.—Inflammation of the kidney.

NEURAL.—Pertaining to nerves.

NEURALGIA.—Nerve pain.

NEURASTHENIA.—Nervous exhaustion.

NEUROSIS.—A nervous affection without obvious disease; hysteria.

NEUROTIC.—Nervous.

NUCLEUS.—The essential part or core of a cell.

NUTRIENT.—Nourishing.

NUTRIMENT.—Nourishment.

NUTRITION.—The state of nourishment or the process of absorbing nourishment.

NUTRITIVE.—Nourishing.

NYMPHÆ.—The labia minora (p. 44).

OBSTETRIC, OBSTETRICAL.—Pertaining to midwifery.

OBSTETRICIAN.—One skilled in midwifery.

OBSTETRICS.—Midwifery; the care of mother and child throughout pregnancy, labour, and lying-in.

OÖPHORITIS.—Inflammation of the ovary; sometimes less correctly described as ovaritis.

OVARIOTOMY.—The operation for removal of an ovarian tumour.

OXYTOCIC.—An agent hastening delivery.

PARAMETRITIS.—Inflammation of the cellular tissue round the uterus; pelvic cellulitis (p. 242).

PARAPLEGIA.—Paralysis of the legs or lower part of the body.

PARESIS.—Paralysis.

PARTURIENT.—The condition of being in labour. The parturient canal is the uterus and vagina dilated for the passage of the child.

PARTURITION.—The act of giving birth.

PERIMETRITIS.—Inflammation round the uterus; pelvic peritonitis (p. 242).

PERINEORRHAPHY.—Suture of the perineum (p. 314).

PESSARY.—Instrument placed in the vagina to support the uterus or vaginal walls (p. 87).

PHENOL.—Carbolic acid.

PHIMOSIS.—Tightness of the foreskin (p. 293).

PHLEBITIS.—Inflammation of a vein.

PHTHISIS.—Consumption; tuberculous disease of the lungs.

PNEUMONIA.—Inflammation of the lungs.

PODALIC.—Pertaining to the feet. Podalic version, turning so as to bring the feet first.

POLYPUS.—A polyp; a tumour hanging by a stalk in one of the passages of the body.

POLYURIA.—Excessive secretion of urine.

PROGNOSIS.—The outlook as to the result of a disease or condition; a forecast.

PROPHYLACTIC.—Preventive.

PROPHYLAXIS.—Prevention.

PRURITUS.—Itching. Pruritus vulvæ—itching about the vulva.

PSEUDOCYESIS.—Spurious pregnancy; phantom tumour.

PTYALISM.—Excessive secretion of saliva. May occur in pregnancy (p. 85).

PUDENDUM.—Generally used in the plural, *pudenda*: the female external genitals.

PULMONARY.—Relating to the lungs.

PYELITIS.—Inflammation of the pelvis of the kidney.

PYELONEPHRITIS.—Inflammation of the kidney and its pelvis. Occurs as a complication of pregnancy.

PYONEPHROSIS.—Abscess of the kidney.

PYOSALPINX.—Abscess of the Fallopian tube, often the result of puerperal infection (p. 242).

PYURIA.—Passage of pus in the urine, *e.g.* in pyelitis and cystitis (p. 248).

RACHITIC.—Rickety.

RACHITIS.—Rickets.

RECTOCELE.—Prolapse of rectum and posterior vaginal wall.

RETROFLEXION.—Bending backwards; *e.g.* retroflexion of the uterus when it is flexed backwards.

RETROVERSION.—Of the uterus, when it is turned back (p. 87).

SACRALGIA.—Pain in the sacral region.

SALPINGITIS.—Inflammation of the Fallopian tube (pp. 242, 326).

SANGUINEOUS.—Bloody; bloodstained.

SANIOUS.—Thin; watery—a sanious discharge is a serous watery discharge.

SARCOMA.—A malignant growth of connective-tissue elements.

SCIRRHUS.—A hard cancer.

SCLEROTIC.—The white part of the eyeball or sclera. Also means hard or fibrous.

SCOLIOSIS.—Lateral curvature of the spine.

SCROTUM.—The pouch which contains the testicles.

SECRETION.—The process of separating substances from the blood. Also the substance or substances separated.

SECUNDINES.—The placenta and membranes.

SEPTUM (pl. Septa).—A dividing membrane.

SINUS.—A large channel containing blood—generally venous. A channel to a suppurating cavity. Any cavity.

SKOLIOSIS.—*See* Scoliosis.

SLOUGH.—Separated dead tissue. *See* Gangrene; Necrosis, etc.

SORDES.—Foul accumulation on the lips and teeth in grave illness.

SPECULUM (pl. Specula).—An instrument for examining canals. Vaginal specula are of various kinds—tubular (Ferguson's), duckbill, and retractor forms.

SPERMATOZOON (pl. Spermatozoa).—The active male element in the seed (semen) (p. 55).

SPONDYLOLISTHESIS.—Vertebral dislocation.

SPONDYLOLISTHETIC PELVIS.—A form of contracted pelvis in which the last lumbar vertebra is dislocated forwards over the sacral promontory so as to narrow the pelvic inlet.

STENOSED.—Narrowed.

STENOSIS.—Narrowing; constriction.

STERILITY.—Inability to become pregnant barren.

STETHOSCOPE.—An instrument for conveying sounds in auscultation.

STIMULUS.—Anything which excites the functional activity.

STRABISMUS.—Squinting.

STROPHULUS.—Gum-rash (p. 297).

STYPTIC.—Having the property of checking hæmorrhage.
SUBCUTANEOUS.—Under the skin.
SUPERFICIAL.—On or near the surface.
SUPPOSITORY.—A solid medicament, melting at the body temperature, for introduction into the rectum or vagina.
SYNCOPE.—Fainting; sudden failure of the heart.

TAMPON.—A plug of cotton wool or gauze.
TENESMUS.—Straining at stool and painful action of the bowels.
TESTICLE.—The male organ in the scrotum which secretes the male element of reproduction; analogous to the ovary in the female.
TORSION.—Twisting.
TRAUMA.—A wound or injury.
TRAUMATIC.—Caused by an injury.
TYMPANITIC.—Drum-like.

ULCER.—A suppurating open sore.
URÆMIA.—Blood-poisoning from accumulation of substances normally excreted by the kidney; occurs in the last stages of kidney disease, and may be like eclampsia (p. 224).

VARICOSE.—Unnaturally swollen or knotted; applied to veins.
VARIX.—A venous dilatation.
VASCULAR.—Relating to blood vessels; full of blood vessels.
VENEREAL.—Pertaining to sexual intercourse.
VESICAL.—Relating to the bladder.
VESICLE.—A small bladder or blister.
VESICULAR.—Composed of vesicles, *e.g.* vesicular mole (p. 92).
VIABILITY.—Ability to live a separate existence.
VIABLE.—Able to carry on a separate existence—used of a fœtus sufficiently developed to live apart from the mother (p. 280).
VISCUS.—An organ: pl. viscera; *e.g.* pelvic viscera, the organs in the pelvis.

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